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SOMETHING FOR NOTHING.

(Editor.)

There is an old Scotch saying that enjoins you to "aye be speirin'," or, in other words, always be inquiring. Thus shall we improve our knowledge and understanding.

On the other hand, some cynic once said: "Advice for nothing is worth it." But it is much easier to be a cynic than a wise man, and one must not confuse wit with wisdom.

We have quite a lot of time for the Scots but we don't go much on cynics.

What we are leading up to is this: Some men on the land meet with failures and know not why. Some others are inquisitive, and want to know; these wisely send their inquiries to the Department of Agriculture, which is at all times ready and willing to supply advice free.

It is the function of the Department to help the farmer to solve his problems. Very often the problem to the farmer is not a problem at all to the Department. This is proved by numerous Bulletins that are issued on a variety of subjects, and can be had free by all persons in the State who are following farming and kindred pursuits.

In an article appearing in this issue the Director of Agriculture (Mr. G. L. Sutton) contributes some interesting data on the part played by science in the welfare of agriculture in Western Australia. Read this; it will enlighten you.

All this information acquired is disseminated quarterly in the pages of this Journal. Bulletins and leaflets are extracted in handy form for posting, therefore, if you are in a difficulty, write and ask.

There are Bulletins on the pests that confound the farmer's labour, and remedies to confound his pestilential enemies; there is advice about crops, and the important industries of the man on the land; and articles dealing with the latest scientific practice for increasing yields and improving products; the best methods of packing and marketing. Officers of the department are pleased to identify specimens of insects and plants; to diagnose diseases of plants and animals and give directions for treatment.

If you are engaged in the agricultural, pastoral, or horticultural industries, the Department is for you. Use it. Don't waste time planning out your own remedies, but write and explain your troubles to the Department, and let it "put you wise."

SOME CONTRIBUTIONS OF SCIENCE TO THE WELFARE OF AGRICULTURE IN W.A.

Being a Paper read by the Director of Agriculture (Geo. L. Sutton) before the Royal Society in Western Australia.

The most tangible evidence in this State of the aid which agriculture has received from Science is the establishment of six huge plants, one each at North Fremantle, Bayswater, Bassendean, and Geraldton and two at Bunbury (with one operating at each centre) for the manufacture of Superphosphate. That their product is an essential factor to success in all branches of agriculture is reflected in their out-turn in a normal season of some 250,000 tons per annum.

Superphosphate is now so universally accepted as one of the needs of agricultural life, that its association with Science is overlooked by the average man. Few people associate the huge commercial enterprise of superphosphate-making with the initial laboratory experiments of chemists who, in the early years of the 19th century, treated bones with sulphuric acid, or with the work of a Dublin physician, Murray, who conceived the idea of using mineral phosphates (Coprolites) to replace the more expensive bones, and who, simultaneously, with Lawes, in 1842, patented the process which proved to be the forerunner of the present one by which our entire supplies of superphosphate from phosphatic rock are manufactured. Incidentally, it may be stated that it was Murray* who first suggested the use of the word "superphosphate" and adopted it in the description of his patent.

Present-day superphosphate is a vast improvement on the original product, and because of its perfect physical condition and its cheapness, it meets the requirements of the agriculturist to a remarkable extent. Its excellence and uniformity are a triumph for the chemist, and a tribute to the administrative and technical officers associated with its manufacture.

A contribution to our agricultural well-being, from another branch of Science —Zoology—was the discovery of the cause and remedy, of what is known in this State as Toxic paralysis or Botulism. This disease is so serious that, from the reports which have reached the Department of Agriculture, the Chief Veterinary Officer (Mr. A. L. McKenzie-Clark) considers that no single disease has a greater death roll or makes a greater toll upon the productivity of our stock, than does this one.

It is now known that this disease is indirectly due to a deficiency of phosphorus in the food. This discovery was made in South Africa, as the result of an investigation into the cause and prevention of "Lamziekte." Some of us had the privilege of hearing the masterly review of the details and results of this investigation, delivered before this society on September 5, 1928, by Sir Arnold Thieler, the senior investigator. He disclosed that the cause of the trouble had been determined and the remedy made available, only after seven years of patient research; and that although the work had been commenced some 20 years previously, and the major problem had now been solved, study was being continued along some of the by-paths which had been opened up.

* "Superphosphate," Vol. V., 1932, pp. 75-86.

The results, following the solution of this problem, provide an excellent illustration of the fact that the benefits of scientific discoveries are not confined by national geographical boundaries. The solution of the problem was destined to have an enormous beneficial effect upon the health and productivity of the flocks and herds of Australia, situated some 4,500 miles away from the site of the original investigation.

Here too, history has repeated itself. As in the case of phosphatic fertilisers bones were first used to remedy phosphatic deficiency in soils, and were later replaced by mineral phosphates in the manufacture of phosphatic fertilisers, so bonemeal was first used as the remedial agent for Lamziekte or Botulism, but is now being replaced with great advantage by the mineral compound dicalcic phosphate, which is not only cheaper than bonemeal but has about twice its assimilability—thus constituting another contribution by Chemistry to Agriculture.

Coming now to a successful contribution made by bacteriology, in which the Royal Society has a special interest, for our foundation President—Professor Dakin—made a preliminary investigation of it in 1918-19. It remained, however, for a member of our Council—Dr. Bennetts—to find the cause of the Braxy-like Disease in 1930, and finally to prove his conclusion and suggest the remedy in 1931. In this case the very tangled skein of a difficult problem was unravelled step by step, as the result of painstaking and almost ceaseless effort. The final stage was expedited by another worker who found that milk was suitable, and water unsuitable, as a carrier for the organism which the experimental animals were required to ingest.

The discovery of the cause of the Braxy-like Disease—Infectious Entero Toxæmia—is leading to the solution of another disease of almost world-wide distribution, the pulpy Kidney Disease in lambs.

Dr. Bennetts has made another very valuable contribution to our agricultural development by his studies of the internal parasites of stock, as the result of which he has compiled a census of them.

With the innate caution of scientists, Mr. Filmer and his collaborator Dr. Underwood are not yet prepared to announce the solution of the Denmark Wasting Disease, but the first positive results have been obtained and it would appear that these investigators are on the threshold of success.

The now recognised stable cultivation practice of the Wheat Belt has been evolved as the result of the systematic experiments carried out on the State Experiment Farms during the past 17 years. As the result of these experiments in the realms of Physics, Chemistry and Botany it may be said that the productivity of a new province—the Eastern portion of the Wheat Belt—has been ensured and stabilised. The up-to-date wheat farmer now carries out his routine work with system and confidence both of which were entirely absent a decade ago. In this connection it is interesting to point out that, of the varieties of wheat which were in general cultivation in this State two decades ago, only two, viz., "Gluyas Early" and "Yandilla King," are cultivated to any extent at the present time. This is largely due to the production of new varieties by cross-breeding and selection, which is a regular feature of the research work of the Wheat Branch of the Department of Agriculture, and in connection with which the late Mr. E. J. Limbourn has done much useful work in the production of "Bencubbin," "Merredin," "Totadgin" and "Noongar." The selection of "Nabawa" by Mr. C. Orchard, at the Chapman Experiment Farm, was the first notable achievement in this connection, and, as indicative of the advancement that is ever to be looked for, it would appear that "Nabawa" which was introduced into cultivation as recently as 1919, is now

likely to be replaced by "Bencubbin." "Noongar" matures very rapidly and is believed to be the earliest variety in cultivation in this State. Its production, or the later production of similar varieties, is likely to make secure the development of that new wheat growing territory lying outside what was the recognised Wheat Belt of a decade ago, and of which Kellerberrin was the centre.

The accidental discovery that "Nabawa" was immune to Flag Smut has rendered possible a new goal for the scientific plant breeder, viz., the elimination of all varieties not immune to this serious disease. In consequence the new varieties "Bencubbin" and "Totadgin" possess this quality and other future introductions must have it.

Coincident with the improvement in the morphological and physiological characteristics of our wheat and oat varieties the milling and baking qualities of the wheat grain have been maintained and, in some cases improved. Despite the present limitations of Cereal Chemistry this has been rendered possible by workers in the laboratory of another past President—Dr. Simpson.

One striking instance of the way in which agricultural research, in connection with the principles underlying the wheatgrowers' practice, has proved of definite economic advantage, is in connection with the very ordinary operation of seeding the wheat crop. To-day, in consequence of the experimental results obtained, the rate of seeding is at least ¼ bushel (15 lb.) less than it was 20 years ago. On the present crop of 3½ million acres the saving in seed would be 875,000 bushels; at the normal price of, say, 3s. 4d. per bushel this is worth £146,000.

Following upon the discovery in 1807 by Prevost (Manual of Plant Diseases, Heald, 1926), that smut spores were of fungal origin, and later the working out of the details of spore germination by Brefield in 1833, measures for the control of "Bunt" and many other cereal smuts by means of fungicidal solutions, were soon forthcoming for the use of farmers. As the result of these discoveries it is possible to eliminate ball smut from our wheat fields, but, unfortunately, farmers do not utilise the discoveries as fully as might be.

A disease known as Septoria, for many years caused tremendous losses in the Geraldton area, and, in 1915, devastated large areas of wheat between Dowerin and Merredin. The fear of this disease has been banished, as the result of the work of the Superintendent of Wheat Farms (Mr. I. Thomas), which has demonstrated the especial importance of sowing varieties in accordance with their period of maturity. In consequence, those farmers who plant varieties at periods which the experiments have indicated the most suitable for them no longer fear Septoria.

Biological control is one of the latest developments of Entomology, and the Entomologist, by its application, has been responsible for the practical absence from our apple orchards of the most serious pest, the Woolly Aphis. It has also been successful in controlling the Mealy Bug, Black Scale, Red Scale in our orchards, Vine Scale in our vineyards, and the Cabbage Aphis in our vegetable gardens. The depredations of many other insects have also been much reduced by the introduction of numerous predators (Lady Birds) and internal parasites. It is interesting to recall that, on my arrival in this State some 20 years ago, the present Government Entomologist (Mr. L. J. Newman) was practically the only Entomologist resident in Australia, who believed and advocated biological control methods; other Entomologists preferred to rely upon the spray pump and other artificial means of control. It is to Mr. Newman's credit that, despite opposition and sometimes ridicule, he has consistently advocated biological control throughout this period with gratifying results. The principle is now generally accepted throughout Australia and in other parts of the world.

The efforts to control Fruit-fly by biological means have not been successful, although various parasites have been tested. In this respect the work in Western Australia is not singular, as similar efforts have been made throughout the world, but without satisfactory results to date. It is, however, owing to Mr. Newman's special study of lure, which appeal to the olfactory senses of the pest, that the orchardist can now keep this pest in such subjection, that it need not now constitute a serious menace.

Recently the life history of the Curculie Beetle has been worked out by another member of the Royal Society—Mr. H. Andrewartha—and, as the result, means for its control have been evolved and, in many cases, successfully adopted.

The study of the life history of locusts, has resulted in measures of control which have been placed in the hands of the farmers, so as to deal with this pest at its source, and before it reaches plague form, thus preventing wholesale devastation of part of the Wheat Belt.

Codlin Moth is a much dreaded pest of Pome fruit, and it has been frequently stated and, in some quarters, is still stated that once introduced into a country it can never be eradicated. Fortunately with the aid of Science, and the co-operation of the orchardist, it has been possible to disprove this in Western Australia. In the twenty-five (25) years from 1903 to 1928 there have been eleven (11) distinct outbreaks of Codlin Moth in Western Australia. These have been dealt with and the pest eradicated. The two latest outbreaks were at Collie in 1925 and Narrogin in 1926, but both these areas are now considered clean, for no Codlin Moth has been found at Narrogin since 1929 and Collie since 1930.

The most serious outbreak was in 1915-1916, when this pest made its appearance at Bridgetown, in a commercial orchard thirty (30) acres in extent, and in the centre of one of the largest and best apple districts of the State. Within a radius of three miles from the infested place there were 1,100 acres of orchards, and the planted area has greatly increased since then.

In no case in which this pest has been dealt with has a commercial orchard been destroyed. As far as numbers were concerned the outbreak at Collie was the most violent infestation this State had seen, and it was in some 700 small home gardens around residences that the pest was principally found. In connection with this outbreak a representative body, consisting of the principal apple-growers in the State, waited upon the then Premier, the Hon. Phil. Collier, and, because of the non-commercial character of the trees in which the pest had been found, and owing to their location so close to the main apple orchards of the State, recommended as the only safe treatment the destruction of both trees and fruit. The Departmental Officers in control of the outbreak—Messrs. Wickens and Newman—had, however, so much confidence in their treatment, based upon a knowledge of the life history of the creature, that it was felt unnecessary to take this extreme measure. This was a very bold step to take, for had their efforts been unsuccessful, they would have had to take the risk of the obloquy attached to failure. Had the pest obtained a permanent footing, the opinion would have been strongly held and freely expressed that, if the Departmental Officers had taken the advice of the growers, the pest would have been stamped out. Fortunately, success was achieved, consequent upon the thoroughness of the Superintendent of Horticulture (Mr. G. W. Wickens) and his officers who carried out the details necessary to stamp out the pest.

It is nearly always difficult and sometimes impossible to evaluate the financial benefits derived from the application of science to the solution of an agricultural problem, but in this connection Mr. Wickens has taken the trouble to do so. He

estimates that the loss to the State which would have occurred had the pest obtained a permanent footing, in round figures at not less than £50,000. It is interesting to note that the annual expenditure of the Department of Agriculture, excluding the vote for vermin destruction, is the same.

The co-operative investigation between the Commonwealth and the State, with Mr. W. M. Womersley and Mr. L. J. Newman as investigators, into methods for the control of two very serious pasture and crop pests—the Clover Springtail or Lucerne Flea and the Red Legged Earth Mite—is still proceeding. The discovery of a predatory Mite which attacks the Clover Springtail is encouraging and points to the ultimate control of the Clover Springtail. Unfortunately, no means for the biological control of the Red Legged Earth Mite has appeared on the horizon. The investigators, however, are till pursuing all possible methods of dealing with this trouble.

One of our past Presidents—Mr. W. M. Carne—as senior investigator is associated with a very important contribution of science to the welfare of agriculture in connection with an investigation into the causes and control of Bitter Pit. It will be remembered that in a paper given by him before the Royal Society he, and his collaborators—Messrs. Pittman and Elliott—also of this Society, in studying the physiology of the apple, especially in connection with the maturation process, found that, what was popularly known as Bitter Pit really consisted of two diseases, one of which was a storage trouble, and the other a physiological one, due to climatic conditions. It was shown that the storage trouble, for which the term "Bitter Pit" was retained, can be largely, if not entirely, prevented as the result of picking for market at the right stage of maturity. How valuable this contribution is likely to prove may be judged from the fact that the Council for Scientific and Industrial Research estimated that the annual loss in Australia due to Bitter Pit (Storage) was round about £100,000.

The factors governing the incidence of the second or field form of Bitter Pit, to which the name of "Cork" was given have been investigated and it has been ascertained that, so far as is at present known, it can only be modified to a minor degree by horticultural management.

Allied with the investigation in connection with Bitter Pit were investigations into Water Core and other physiological diseases generally, known as Break-down. The investigations with these have shown, in the case of the "Jonathan" variety, that in taking measures to eradicate Bitter Pit, the danger to "Water Core" is increased proportionately, and, as this is followed in the ship's hold by serious breakdown of the tissues, the obvious conclusion is that this variety is unsuitable for export and should be replaced by others which are suitable. Largely as the result of the investigation which was focussed upon the defects of this variety, this practice is now being followed by orchardists.

A noteworthy contribution has been the eradition of the Black Spot or Scab Disease in apples due to the fungus known as *Venturia insequalis*, as a result of the combination of chemical, mycological and agrostological knowledge. This disease made its appearance from some unknown source at the end of the summer in 1930, in an orchard at Manjimup. So seriously was the introduction of this disease regarded, that the uprooting of the commercial orchard of 17 acres in which the disease was found, was recommended by orchardists generally, and particularly by those in the adjoining districts. Compared with the loss which would have occurred had this disease become established the cost of destruction of a single orchard would have been infinitesimal, but the objection to such a course was the uncertainty as to whether the disease might not also be discovered in other orchards,

when the cost of a general uprooting of orchards would be prohibitive. As a matter of fact about three weeks later a report was received as to its occurrence in an orchard at the Porongorups. It was decided, therefore, to take such steps as the life history of the disease indicated would certainly control and probably eradicate it. The Mycologist advised that the infection was carried over from year to year and was distributed to other places by means of the infected leaves, which fell to the ground in the Autumn. To counteract the danger of the spread of this infection, due to the leaves being blown about by the wind from place to place, the Agronomist's aid was sought in order to secure a plant which could be sown on the orchard and which could be used as a trap for the leaves to prevent their dispersion by the wind. Such a plant was found in a quick-growing variety of oats. It was anticipated that this would hold the leaves and that when these were ploughed in, prior to the release of spores from the leaves in the Spring, re-infection of the trees in the orchard would be prevented, provided that the burying of the leaves was efficiently carried out. To guard against the possibility of the above-mentioned burying of the leaves being rather less than 100 per cent. efficient, the Mycologist further advised that certain chemical compounds would destroy the germinating spores if it was deposited upon them.

To provide this measure of protection, the Horticulturist then played his part by thoroughly spraying the trees with a copper compound, so as to provide the lethal trap for the spores. To ensure 100 per cent. efficiency in this connection, the trees were covered with this copper compound three times, from the bud-bursting stage to the fall of the petals, which was the critical danger period under the climatic conditions, which obtained in the district where this disease was being fought. Fortunately, the measures adopted proved entirely successful at both places. Observation the next year showed that, in the orchard in which it was first found, no evidence of the disease was present. In the other orchard at the Porongorups, one apple was found infected and this was destroyed. The treatment was continued and last year no evidence in that orchard was found.

The chief contribution of the many, which Botany has made to agriculture, is the census of the plants of Western Australia by our Secretary—Mr. C. A. Gardner. This work is fundamental to the initiation of many research problems in other branches of Science, as well as in Botany, and is preliminaary in the production of a State Flora. Other contributions from Botany are the determination and study of the Poison Plants of the State and the identification and suggested methods of control of noxious and other weeds.

The Dairy Industry has been aided very materially by Science. The quantity of pasture has been increased and its quality improved as the result of fertilisation and scientific management, as well as by the deliberate introduction of new and improved pasture constituents. The result of this has been that annual pastures are being superseded largely by permanent ones and the period of active growth is being expedited and extended.

The placing upon the Statute Book of the "Cattle Improvement Act" is the logical and political application of the discovery in Genetics, that productivity is an inherited constitutional character. This law has also been recognised by the farmer by the introduction of egg-laying competitions and by the formation of herd testing and milk recording associations.

The economic foundation of the production and commercial manufacture of butter rests upon one of the discoveries of applied science, viz., a method for the rapid determination of butterfat in milk and cream. In this State the method

in universal use is that worked out by Professor S. M. Babcock in 1890, who then, so that it could not be commercially exploited, patented it for the benefit of dairymen.

In the realm of soil Science, an important piece of work is now proceeding as the result of co-operation between the Lands and Agricultural Departments. This is the Alkali Survey of certain portions of the agricultural areas. This work is in the charge of Dr. Teakle, who has associated with him Mr. S. J. Stokes, of the Lands and Survey Department, who is responsible for the surveys and camp organisation. On the chemical side Dr. Teakle has as his principal assistant a chemist—Mr. L. W. Samuel—who previously had done original work in connection with the technique associated with the building up of the synthetic Hormone Thyroxine.

Western Australia is to be congratulated upon the excellent land classification, which has been carried out by the Survey Branch of the Lands Department. It, however, has been based upon the botanical and field examination of soils without chemical assistance, but, as the result of a rapid chemical reconnaissance, which was carried out by Dr. Teakle, it was definitely shown that such classification without chemical assistance could not be relied upon in certain districts, to indicate the area and distribution of the land suitable for settlement. The results of further and more detailed surveys by the Chemist and Surveyor have already proved of considerable economic value in two ways. In the first place they have prevented the placing of a number of settlers on land, which these investigators indicate is unsafe, and, in the other direction, they have restored confidence in the settlement of land in other areas about which settlers, owing to other factors in operation, were having some doubt.

Arising out of the problem of the settlement of these alkali lands is another one in connection with which investigation is proceeding, and that is the selection of plants which, because of their natural resistance to alkali, are the most suitable for cultivation on this type of land.

Many more instances of the way in which Agriculture is indebted to Science could be cited, but from what has been stated it must be evident that the fundamental Sciences of Physics, Chemistry, Geology, Botany, Zoology and Genetics have contributed to the advancement of agriculture in Western Australia in all its branches. Few farmers realise this, for the scientific discovery of to-day becomes the common-place of to-morrow. So much is the agriculturalist using the results of scientific investigation, that it is almost correct to describe him as a worker in applied Science, using the discoveries of his brother in pure Science.

Without the traditional experience of centuries which older countries possess Western Australia, with entirely new conditions, could not possibly have made the tremendous agricultural advance it has without the guidance which comes from Scientific research. It is fortunate that the State has provided the research facilities which have made such progress possible. The wonderful successes of the past can, and should, inspire present workers with the hope of similar successes in the future. Let us, therefore, continue to urge that facilities for Agricultural Research be increased to the limit of the State's financial resources, for, as a writer in the Journal of Chemistry, June, 1932, quoting Dr. Ames, states, "Over production can never take place in Arts, Education, *Scientific Research*, or Medicine."

STRANGLES IN HORSES.

(A. McK. Clark, L.V.Sc., Chief Veterinary Surgeon.)

This is an infectious disease due to bacteria, which usually affects young country-bred horses when brought into town and allowed to drink out of public horse troughs. It causes nasal catarrh, and when the lymphatic glands under the jaw are infected they swell and finally form abscesses and swelling of the throat under the throat strap. Its spread is facilitated by the movement of horses. This is especially so when purchases are being made by dealers who collect them in depots prior to sale. The buyers of such horses should, therefore, take care that these animals are free from the disease and are isolated for some four weeks at least before allowing them access to common drinking troughs and mangers. Strangles if treated correctly do not cause a high rate of mortality and can, in the majority of cases, be treated successfully.

Symptoms.—The horse becomes dull, loses his appetite and becomes feverish, temperature rising to 103 deg. F. or higher. Discharge of pus from the nostrils, the mucous membrane being a dark red colour. Sometimes the glands escape infection but usually after a few days they commence to swell and in about 10 days require lancing with a sharp knife. Complications may occur due to extension of the catarrah towards the lungs and stomach, and the germ may enter the general circulation setting up abscesses in the kidneys, liver, lungs and joints. When the temperature rises to 104 deg. to 105 deg. F., it is usually a sign of complications being present, and usually if death occurs it is due to septicæmia. Purpura hæmorrhagica sometimes follows attacks of strangles, in which case the head and legs will gradually become œdematous and swollen and the skin exude serum in patches. The swelling becomes well marked, in some cases interfering with breathing, and most of these cases end fatally after a long illness. Also pneumonia may supervene which invariably proves fatal.

Treatment.—This should consist of actually treating the symptoms as they develop. Affected horses should be isolated and put *out of work* immediately. Place in a loose-box or some area sheltered from draughts yet well ventilated. Should the breathing be distressed it may be necessary to administer inhalations of eucalyptus oil and turpentine. This should be done by placing some straw in a nose-bag and pouring over it boiling water; then add to this one tablespoonful each of eucalyptus and oil of turpentine.

If the larynx is inflamed the animal will have difficulty in swallowing and when attempting to drink, water will flow through the nose. In this case the water should be elevated to the level of the chest in order to assist the horse to drink easily. Ample water should be provided. Do not drench with medicine but give the following electuary:—

Extract of Belladonna, 1 ounce.
Potassium Chlorate, 4 ounces.
Ginger, 4 ounces.
Treacle, sufficient quantity.

One tablespoonful of this mixture should be placed on the tongue twice daily.

Should swellings appear in the region of the throat they should be rubbed for 10 minutes with an ointment composed of Red Iodide of Mercury 1 part, Lard 4 parts, or mustard made into a paste with cold water. When these swellings or abscesses become mature or soft and pointing at the top they should be lanced with a knife and allowed to drain freely. Wash the wound out daily with a disinfectant solution such as Lysol, etc. Feed on green feed or bran mashes and keep the stable and resting paddocks clean.

BULK HANDLING.

A Correction.

In "A Case for Bulk Handling in W.A.," published in the last issue (September, 1932) of this Journal, the financial results of the operations of three farmers handling wheat under the Experimental Bulk Handling Scheme are given (pages 364 and 365). It was shown that the average saving due to handling in bulk in the three cases quoted amounted to 2.33d. per bushel. Since then it has been learnt, as the result of evidence given to the Bulk Handling Commission (*vide* Report, p. 223, question 4930), that the arrangements with the millers, who purchased the bulk wheat, were that the millers be supplied with the number of bags necessary to hold the wheat if it had not been bulked, and that the millers would credit the Bulk Scheme with the savings resulting from handling the wheat in bulk. Though this did not affect the farmers, whose transactions were cited, it is considered that part of the cost of the bags should have been taken into account and the savings, as shown, reduced accordingly. This would have been done had the details of the arrangement with the millers been available at the time. It, however, would not have altered the estimated savings due to bulk handling (page 370) and shown to range from 2.93 to 4.53 pence per bushel, as these final conclusions were not based in any way upon the costs of the experimental installation.

GEO. L. SUTTON.

RYEGRASS—HAWKE'S BAY.

From time to time the Department of Agriculture, per medium of the "Journal" and other advices, has stressed the advantage of seed testing. It is no less necessary that when a high standard has been obtained by a certified grower of seed, the purchaser should be assured that the seed he buys comes from the producer he desires to patronise. We have recently received a communication from Mr. J. A. Simson, the Hon. Secretary of the Hawke's Bay Association of Certified Grass Seed Growers, who, writing from Hastings on the 4th October, states:—

HAWKE'S BAY ASSOCIATION OF CERTIFIED GRASS SEED GROWERS.

P.O. Box 81. Hastings,
4th October, 1932.

The Director,
Department of Agriculture,
Victoria, New South Wales, South Australia, and
Perth.

Dear Sir,—During the past few months it has been evident that ryegrass grown in Hawke's Bay has been purchased by firms in your State and it has come before us through advertising catalogues where Hawke's Bay ryegrass is being sold but in many cases it has been found that Hawke's Bay ryegrass has not been distributed but is some other certified ryegrass grown in some other province of New Zealand.

In setting out this memorandum I would like to point out on behalf of my Association that as a guide to ensure the farming community of your State that they will be purchasing the genuine Hawke's Bay certified ryegrass by looking for the following markings on bags, tags and insert slips.

As far as our merchants are concerned they always stencil on their bags "Guaranteed Hawke's Bay grown; machine dressed by (the name of the firm)." The Department of Agriculture supervises all the certification and they issue insert slips and tags

according to the classification of the seed. On the insert slips and tags there will be found "Grown on Registered Area No.....''; following this will be "H.B./107" (Grower's number), and then paddock letter following the registered number. H.B. stands for Hawke's Bay district, whereas if S.C. was on the tag this would indicate that the area harvested was in South Canterbury. There is nothing really to show the farmer that the seed was grown in Hawke's Bay except by looking for H.B. on insert slips and tags or, in some cases where firms adopt the method of branding the bags, as follows:—2 HB/107 and paddock letter over the code letter for seed classification.

It is my Association's intention to ask the Department of Agriculture to have printed over the tags and insert slips the name of the province in which the seed is grown. For our concern the words "Hawke's Bay grown'' would be printed across the tags and insert slips.

This attention was drawn to us by a farmer of your State visiting this locality and he said that there was no guarantee whatsoever from the merchants that the farmer was receiving genuine Hawke's Bay certified ryegrass, and to his sorrow in some cases Wimmera ryegrass has been sold, so he has asked our Association whether it would be possible for us to put up certified seed in containers of three-bushel bags. This, however, is now under consideration with the merchants and Department of Agriculture.

My Association would be grateful if your Department would publish an article, or outline the system, in your "Journal'' so that the farmers may be educated up to the idea of what to look for when purchasing the certified ryegrass seed as being advertised by the local merchants. We would not like to see the good name of our perennial ryegrass being abused in any way. This factor alone is of very grave importance to us, particularly where the trading enterprise is just opening up. I am sure if the genuine article is purchased and grown every satisfaction will be obtained as this grass has now been tested out in different parts of the world and has proved itself as to its permanency and good name it attains.

It is somewhat unfortunate that the prices this year have been so high, but this is due to one factor that seasonal conditions in the other provinces have been very adverse to crop production and we are the only province that has made an average harvest, so the demand has been high; thus prices reached a high level. It will probably be found that in future years, when three or four provinces are competing, the prices will be about 50 per cent. lower, and this alone, I am sure, will cope with the wants of our overseas buyers.

Hoping that this favour is not going to inconvenience you in any way, I would like to offer the thanks of my Association for anything that is done to further the interests of our grasses.

Yours faithfully,

(Sgd.) J. A. SIMSON,
Hon. Secretary.

HORTICULTURAL NOTES.

Geo. W. Wickens, Superintendent of Horticulture.

At time of writing—November—nearly all kinds of fruits, excepting citrus are sufficiently forward to show that on the whole a favourable setting has taken place, and the outlook for a good crop is decidedly encouraging. The first of the new season's fruits—loquats—appeared on the market some time ago, and it is to be hoped the quality of the first comer cannot be taken as an indication of the standard of those still to arrive. The loquat crop this year was the heaviest I have seen in the State, and as very few growers thinned, there was a big quantity of small and unsaleable fruit.

Stone fruits—apricots, peaches and plums—have set abundantly, and unless orchardists thin drastically, an experience similar to that with loquats will take place.

Pears throughout the State are uniformly good and are freer from scab, Venturia pirina, than for several years past. If the overseas pear market is as good in 1933 as it was in 1932 pear growers will have a profitable export season.

The apple crop is not as easy to gauge now as it used to be, owing to the fact that the thrips visitation in season 1930-31 put one big producing district, viz., Cranbrook, Mount Barker, Albany, out of step with the remainder of the State; but allowing that the district mentioned, which had a very heavy crop last season, will be much lighter this, it is not by any means the failure that occurred in the thrips year, and with a good to heavy crop in other parts the present indications are that the yield for the State will be above the average.

The grape crop varies very little from year to year, and this season promises to be no exception to the general rule of good crops, and excellent quality.

Citrus trees blossomed well and the young fruit at the present time look promising, but it is not possible until after shedding has taken place to forecast what the crop will be.

In the August issue of the "Californian Citrograph" I came across some verses which will bear reproduction in our "Journal," for with the exception of frost, which is a minor danger to fruitgrowers here, the other stanzas might easily have been written for Western Australia, and during a close acquaintance with growers, now extending over 30 years, in which I have seen scale and codlin moth vanquished, hailstorm and drought borne without moaning, bad fruit culled and good fruit well packed, I have definitely formed the opinion that, while no doubt there are some who slip, particularly on the cull pile, it has been my good fortune to meet quite a number of dinkum orchardists.

IF—

(With apple-ogies to Kipling.)

If you can spray when Scale seems cleanly vanquished
And do a real job of it, year on year:
If you can lick the Codler to a finish
And send your fruit abroad without a fear:
If you can watch a hailstorm strip your orchard
Leaving your hopes and work a blasted mess,
And gather up your notes to face the bankers
And do it so the World can never guess:
If you can sleep spring nights as winter clutches
Your slopes, just bursting into pink-white bloom,
And see them in the morning sun change swiftly
From life to deadening brown, yet show no gloom:
If you can watch the Drought burn up your apples
With rainless, dancing dazzle day by day,
And keep on thinning as you watch them shrivel
And still have faith your work is going to pay!
If you can let your apples hang to ripen
Nor yield to crafty pleas to "sell them quick,"
If you can throw ALL bad ones in the cull pile
Nor stoop to cheat with outworn packing trick:
If you can grow one full carload per acre
And pack the way The Public wants it done:
If you'll do these you'll never need financing
And more—you'll be an Orchardist, my son.

WEST ARTHUR PASTURE COMPETITION, 1932.

JUDGE—A. S. Wild, Agricultural Adviser.

The inspection of the 5-acre pasture plots entered in the West Arthur Pasture Competition was made on the 31st October to 2nd November, and awards were made as follows:—

Competitors.	District.	Yield.	Freedom from Weeds.	Useful Grasses.	Freedom from Disease.	Evenness of Growth.	Total.
		40 pts.	15 pts.	15 pts.	15 pts.	10 pts.	100 pts.
R. Schinzig ...	Duranillin ...	40	14	12	13	9	88
Mrs. Cameron ...	Collie	27	13	14	14	9	77
Mrs. Cameron ...	Collie	26	14	14	14	8	76
A. Holmes	Duranillin ...	23	14	13	13	9	72
T. H. James ...	Darkan	20	14	14	13	8	69
H. Barron Rodway ...	Darkan	18	13	13	13	8	65

The rainfalls as recorded during the year at the centres concerned were:—

Centre.	April.	May.	June.	July.	August.	September	October.	Total for Growing period.
Duranillin ...	76	492	518	555	265	174	211	2,291
Collie ...	188	840	799	1,000	416	266	202	3,728
Darkan ...	102	588	443	580	329	98	203	2,343

Mr. R. Schinzig's winning pasture had been established during 1926 on land which had just been cleared of its white gum, jam, blackboy and stinkwood timber. During that year it was ploughed and planted with 60 lbs. of oats and 2 lbs. of subterranean clover seed per acre, while superphosphate was applied at the rate of 90 lbs. per acre. Each year since, it has been topdressed with an application of 90 lbs. of superphosphate per acre during the month of April. Sheep had been depastured on this plot up to the middle of August. It was calculated to yield about 13 tons of green fodder per acre.

Mrs. Cameron's two entries were both from the same property, located about eight miles west of Collie. Both plots had received similar treatment, being cleared of blackbutt timber three years previously. After ploughing, 90 lbs. of unslaked lime were applied per acre. This was followed by an application of 135 lbs. of superphosphate during the next year, when 1 lb. of subterranean clover and 2 lbs. of mixed grasses were sown per acre. During 1932 a bag of potato manure was applied to each acre and, in the case of the first pasture, this was followed by the same quantity of superphosphate. The entry which was awarded second place to that of Mr. Schinzig's was calculated to yield 8.7 tons of greenstuff per acre, although it had been stocked up to the end of September, 40 acres carrying 130 ewes, 77 lambs and 20 head of mixed large stock.

The pasture entered by Mr. A. Holmes had been established on a white gum flat. After being cleared the land was ploughed and seeded with 60 lbs. of oats and 1½ lbs. of subterranean clover per acre, 112 lbs. of superphosphate being applied also. During April of the following year the plot was top-dressed with superphosphate at the rate of 60 lbs. per acre. Early in 1932 the land was again ploughed after the first rains, cultivated, harrowed, and sown with 1½ lbs. of early subterranean clover seed and 50 lbs. of oats, superphosphate being applied at 112 lbs. per acre. This pasture was stocked with cattle up to the end of June.

Mr. T. N. James submitted the same pasture plot which had been inspected the previous year. The land which had carried white gum timber and blackboys had been cleared in 1928, ploughed during October, 1929, and planted at the end of May, 1930. Oats were planted at the rate of 40 lbs. per acre and the very early variety of subterranean clover, "Dwalganup," at 1½ lbs. per acre, superphosphate being applied at the rate of 112 lbs. per acre. The first year's growth of clover had seeded well, producing an excellent stand during the second year, 1931, when it was calculated to yield 6½ tons of green fodder per acre, although stocked up to the time of inspection. During May, 1932, the plot was topdressed at the rate of 112 lbs. of superphosphate per acre. It had carried large stock since the 1st of June, but was calculated to yield about 6 tons of green fodder per acre.

Mr. H. Barron-Rodway's pasture had been established for many years on land which originally carried red gum, blue gum and manna gum. It was ploughed first after clearing about 25 years ago, and scarified at intervals of about 3 years, the last scarifying taking place about two years ago. About 80 lbs. per acre of superphosphate are applied to the pasture each year.

CHICKEN REARING.

By A. C. Jenyns,
Poultry Adviser.

This section of poultry farming is perhaps the most difficult, and has certainly the most serious bearing on the future success of the farm. It is a comparatively simple matter to get the eggs hatched, but it is then the *real* trouble begins. If strict notice is taken, the average poultryman will realise that he loses more chicks in rearing than eggs in incubation. This statement will no doubt cause much adverse comment, mainly due to the fact that the comparison has never been made, for I will agree it is not nice, to say the least, to admit to large losses due to no apparent cause.

The first and main cause of chicken morality is due to chills, and once baby chicks get chilled there is little or no hope of cure, owing to the lungs being so easily and quickly affected. Then Cocciodiosis is a disease which seems to be getting a greater hold each season.

In the case of chills there are many causes—incorrect or draughty quarters, and as an even greater cause, too much warmth and close confinement. Chicks are like plants; to be strong and hardy they must have plenty of freedom and fresh air, with just sufficient warmth to counteract any drop in temperature; sunlight and sun heat is the most necessary item on the daily ration. It will be seen, therefore, that the brooding houses and interior systems must be given careful thought before erection. The habit of getting plans and ideas from literature written in other countries or states where the climatic conditions do not coincide with ours is the cause of much trouble and loss, for the best type and position of brooder houses and outside conditions varies with almost every district, and the correct type and position can only be determined by a careful study of the farmer's local conditions, such as angle of sun, winds, and slope of ground, etc. Many a loss from this cause is through the incubator house being too far from the brooders. I have seen many cases where hundreds of chickens have been lost through getting chilled in the transfer from incubator to brooder house. Clean dry sand is the best cover-

ing for the floors of brooders, green chaff should be especially avoided, as this sets up a dampness and humidity which fouls the whole atmosphere of the brooder house.

Coccidiosis.—This disease is spread very often through second-hand incubators, as the germ is left in the machines by affected chickens; then, as many poultry farmers never disinfect and thoroughly clean their incubators, the disease is carried on when machines are sold or changed from one farm to another. Incubators, brooders, brooder and incubator houses should be thoroughly cleaned and disinfected before and after using. Most cases of diarrhoea are put down to coccidia or bacillaray white diarrhoea. This is generally the wrong diagnosis. In my experiments and observations over the past six or seven years, I have proved that in a great many cases the trouble is wrong feeding. By this, I mean that there is too much indigestible matter given to chicks in the early stages. Pollard except in very small quantities should not be fed to young chickens, especially in dry hoppers. Bran should be the main food, with cracked grain at will. I have many times had brought under my notice chickens with pasty vents or what appeared to be diarrhoea. These were being fed on pollard and bran in some cases and gristed wheat (with the flour left in) in others. I immediately caused the ration to be altered to bran four parts, pollard one part, and the wheatmeal to be screened and the flour taken out. Within three days the pastiness had disappeared and the chicks were clean and healthy. The increasing use of artificial or chemical foods for chicks is causing the stock to gradually deteriorate. That this is correct is borne out by the fact that trouble with young chicks is increasing more on farms using these foods than on those which are using plain natural foodstuffs.

From the first day baby chicks should be given water to drink and clean bran to pick at, not to be (as is the general method) shut tightly in a small brooder with no free fresh air for three days, but given space to run in and get drink and food when they want it. (Skimmed milk, of course, is preferable to water where available). Where the milk is used the water must also be always available to the chickens. After three or four days gristed wheat in a small hopper should be before the chicks all the time, with a damp crumbly mash consisting of four parts bran to one of pollard or wheatmeal, and two per cent. bonemeal three or four times daily. At three weeks, 1½ per cent. meatmeal to be added to the mash and the size of the cracked grain increased slightly. When six to seven weeks old the mash alters to three parts bran to one part pollard or wheatmeal, increasing the bone meal to 2½ per cent. and withdrawing the meatmeal entirely. This mash, with a gradual increasing of the size of the grain in the hopper will carry the stock till five months old; then 2½ per cent. meatmeal to be added and increased gradually to five per cent. at six months, when the pullets should be commencing to lay.

Though the above method of feeding is antagonistic to most of the prevailing ideas, it will be found correct inasmuch that it will eliminate the great trouble (commonly known as pasty vents) and give greater and quicker body development before sex development takes a hand and starts the pullets laying small eggs, owing to improper feeding and handling forcing sex maturity before the body of the bird is sufficiently developed to do the job efficiently and profitably.

Late hatched chicks (*i.e.*, hatched later than September) are always more trouble to rear than the earlier hatches, and even when reared are more liable to contract sickness and disease. Beginners in buying chicks should stipulate the late July to early September hatches, if they wish to get good healthy and profitable stock. The chief reason for weakness and lack of vitality in late-hatched chicks is the fact that the hens have been laying for a long period and have become stale and lowered in vitality themselves. The male bird has also had a hard long

season and the germ become much weaker, so it will be seen that the combination of these two factors in mating can only give progeny of lowered vitality and resistance to disease. This is especially noticed where large quantities of chickens are hatched and the rearing done in battery brooders or other large scale methods. The battery brooder system has its good points, but I am confident that it tends to the detriment of the chickens raised and so ultimately to the lowering of the standard and vitality of the poultry in Western Australia; for in using battery systems where large quantities are required, it is difficult to avoid using eggs which are obtained from stale hens and more or less devitalised male birds, whereas in proper mating on a small scale, due attention can be paid to these details.

GRADE HERD RECORDING.

G. K. Baron-Hay,
Superintendent of Dairying.

The testing of pure-bred cows has been conducted in Western Australia since 1918, under the Australian Pure Breeds Herd Recording Scheme, but until the present no testing of grade cows has been carried out. This has been mainly due to the belief that the best interests of the State would be served by conducting Pure Breed Herd Recording and assisting farmers in the purchase of pure-bred bulls ex such officially tested cows, in order to grade up the existing milch cows in the State. It was also considered that in view of the very rapid increase in the pasture areas of this State, that all the existing dairy stock would be required for the adequate stocking of these areas, and such cows, although low producers in themselves, were valuable potential breeders of dairy heifers when mated with the type of bulls supplied to farmers. In support of the above it may be mentioned that the area of sown pasture increased in 1922 from 18,441 acres to 339,371 acres in 1931, a truly phenomenal performance.

During the last two years it has been realised, however, and the fact has been brought under the notice of the Department on many occasions, that in the older districts of the State farmers have increased their herds to a size that would warrant culling, and requests have been made for Grade Herd Recording to be carried out. This has not been possible, however, owing to the withdrawal of the Commonwealth grant in 1931 and the State Government not being in a position to finance the scheme without this assistance.

In September, however, the Government secured a grant of £1,000 from the Commonwealth Bank, which has been supplemented, and will allow Western Australia (the last of the States) to institute a scheme for herd recording in Grade Herds.

Some doubts have been expressed as to whether the State is yet in a position to commence Grade Herd Testing, but examples are not lacking in Australia to indicate that the policy now initiated is one that will increase the average production of herds very rapidly. Grade Herd Testing is of comparatively recent origin even in the older dairy States, such as New South Wales and Victoria, but the results in each of these States have been spectacular and well worthy of notice.

Grade Herd Recording was initiated in New South Wales in 1923-24, when 9,000 cows were tested, and the movement was so successful that each year a substantial increase in the cows tested took place, until in 1930 no less than 100,000 cows were under test in addition to Pure Breed Herds.

In Victoria, where the scheme was started three years earlier, 1,600 cows were tested in 1921-22, averaging 165 lbs. of butter fat; in 1930-31 the number tested had increased to 93,664 cows, with the excellent average of 246 lbs. of butter fat per cow, the State average being approximately 156 lbs. per cow, or 96 lbs. per cow less than those cows under test.

In Queensland, where grade herd recording is still in its infancy, it is significant that the yield per cow is the next lowest to that of Western Australia, the latter being the bottom of the list. In Queensland, however, where herd recording is practised, similar remarkable increases are taking place in production as have been mentioned above. The following results of only three years testing obtained in the Atherton Tableland, will prove interesting, especially in view of the low initial production of the cows.

HERD RECORDING IN ATHERTON DISTRICT, QUEENSLAND.

Year.	Number of Cows.	Average Yield Butter Fat.
		lbs.
1927	296	137
1928	419	156
1929	518	168

The present juncture is most opportune to commence Grade Herd Recording, as every dairyman is confronted to-day with the spectacle of falling prices for his main commodity, namely, butter-fat. The reduction of costs is extremely difficult in a young country where farms are still in the developmental stage. One avenue of reduction is by obtaining higher yields per cow, which is practicable whether the farm is highly developed or not. While it is not claimed that herd recording will of itself effect this, it enables the dairy farmer who uses the information obtained by the possession of such records, to eliminate unprofitable cows, and by better feeding methods with the remaining cows, considerably increase his average herd yield.

Results, too, are relatively rapid, and compare favourably with those obtained by breeding from pure-bred bulls ex tested dams, the breeding and culling going hand in hand.

The following table, obtained in Victoria, shows with what rapidity results may be expected:—

HERD RECORDING AND INCREASED PRODUCTION.

Year commencing Test.	Average Yield in First Year.	Average Yield in 1929.	Increase in Average Yield.
	lbs.	lbs.	lbs.
1921	183	257	74
1922	180	259	79
1923	177	269	92
1925	193·5	252	58·5
1926	165	220	55

This table shows that in Victoria an average increase of 55 lbs. was obtained in three years, while in those associations where testing had been in force for longer periods, the increases were considerably higher. If these results can be obtained in this State, and there is no reason why they should not, then the average production of those cows under test will be more than double that of the average cow in Western Australia.

The rules for the conduction of grade herd recording, which are given hereunder, have been designed to further develop the policy of "grading up" herds with the use of pure-bred bulls ex tested dams combined with the culling of low-producing cows.

Rule 6 requires that, within twelve months from the commencement of testing, at least 20 per cent. of the bulls owned by members in a sub-unit shall be pure bred ex tested dams, and this number shall be increased annually until at the end of five years 100 per cent. shall be pure-bred bulls ex tested dams. It is anticipated that this will have the effect of further increasing the demand for pure-bred bulls, and for this reason alone the extension of grade herd testing throughout the State should be advocated by stud breeders.

While it is believed that dairy farmers generally are seized with the value of pure-bred bulls for the breeding of dairy heifers, a fear has been expressed that in individual cases farmers owning a very high-producing grade cow may be tempted to rear a bull calf from that cow for breeding purposes. *Rule 7* provides against such a contingency.

Moreover, in the records which it is intended to keep, the sire and dam of every cow tested, as far as is known, will be noted. In a short time the result will be that such pedigree bulls or particular lines of blood in a breed will become known as prepotent for milk or butter-fat production, and will lead to a demand for pedigree bulls from that particular stud or line of breeding. This again should be of considerable benefit to those stud breeders whose herds are officially tested and whose stock "prove" themselves for butter production.

RULES GOVERNING THE FORMATION AND OPERATION OF GRADE HERD TESTING IN WESTERN AUSTRALIA.

1. The State shall be considered as one Testing Unit.

2. The Superintendent of Dairying shall control the formation and administration of the herd-testing movement.

3. Sub-units may be formed and conducted in suitable centres in dairying districts, and shall be in compact areas so as to avoid lengthy travelling by the Tester in carrying out his duties. Each such sub-unit should contain approximately 20-25 dairy herds with not less than 350 cows.

4. Each Sub-unit shall be given a number for identification and recording purposes.

5. Every member undertakes to effect, and does effect, the culling from the herd of all cows which, having reached the age of six years, have failed in each of two consecutive lactation periods to produce 150 lbs. of butter-fat.

6. Members of each Sub-unit undertake that, within twelve months of the establishment of the Sub-unit, 20 per cent. of the bulls being used for service in the herds of members shall be pure bred and ex dams which have been tested under

Government supervision and have reached the standard prescribed by the regulations governing the testing of pure-bred herds, and that the percentage of such pure-bred bulls shall increase at the rate of 20 per cent. per annum thereafter.

7. Members undertake not to rear any bull calves to be sold for use as sires in dairy herds unless these are ex pure-bred cows and sired by pure-bred bulls.

8. Only Testers in the employ and under the direct control of the Department of Agriculture shall carry out grade herd testing under this scheme.

9. The official testing year shall cover the period from 1st May to 30th April following. New Sub-units may be formed to commence operations at any period between 1st May and 31st October, and in such cases the period of the test shall be from actual date of commencement to 30th April following.

10. Dairy farmers who desire to become members of the State Grade Herd-testing Scheme and join Sub-units must submit for testing and pay fees for every cow in their herds with the exception of those sick, disabled, etc., up to 10 per cent., and shall pay for a minimum of 10 cows. Applications for exemptions must be certified by the official Tester.

11. The Testing Officer shall be supplied with the following details of each cow in each member's herd:—Age, colour, marks or brands, and date of calving, and also the pedigree to the extent known.

12. The following means shall be adopted to identify cows tested:—

(a) Each cow shall be tattooed in the ear with a letter and a numeral indicating the Sub-unit and number in that Unit.

(b) A list of all cows in the herd shall be placed in each milking shed or otherwise available to the Tester.

13. The Testing Officer shall weigh the milk yielded by each cow at each milking during the period of his visit, and shall take fair samples of each cow's milk at the rate of 1 c.c. of milk for each pound weight yielded at two consecutive milkings, and shall ascertain by the Babcock method the butter-fat content of such milk.

14. The Testing Officer shall, if asked, give to the member a check sample of the milk at the same time as he takes his own sample for testing.

15. The Official Tester shall leave with each farmer a duplicate copy of each test day's work made out on the field-sheet provided.

16. *Abnormal Tests.*—In cases of cows testing abnormally, *i.e.*, more than 25 per cent. above or below the normal milk and fat yield at the time of the Tester's last visit, such test shall be discarded and the average of the preceding and succeeding tests taken. Any such abnormality should be shown in the "Remarks" column. Where the first test is abnormal, the production for the first sub-period should be calculated from the average of the two succeeding tests.

17. Fee for herd testing shall be 2s. 6d. per cow per annum, such year to end on April 30th. The fee may be paid on application, or half this fee will be accepted on application, the remaining half being covered by an order on a butter factory payable within three months, such order to be given at time of application for testing.

18. The full fee of 2s. 6d. shall be paid on the estimated number of cows to commence their lactation period by 31st October each year. When any variation occurs, the amount shall be adjusted annually.

19. The fee for newly purchased cows, or cows calving after October 31st and submitted for test, shall be 1s. 3d. per cow, and the official year shall be the broken period up to April 30th.

20. For the purpose of assessing fees due to the Association, every cow once tested shall be deemed to be a cow submitted for test.

21. Testing or membership fees will not be refunded to a member after the first test of his herd has been carried out. If a member discontinues testing after his first or second test, he must continue to pay the instalments on full fee charged for each cow entered for test, except with the approval of the Superintendent of Dairying.

22. Each herd in a Sub-unit shall be tested at least once monthly, the order in which herds are to be tested being decided by the Official Tester, and he shall not notify members, directly or indirectly, of the intention to visit.

23. The Tester shall forward quarterly to the Superintendent of Dairying, Department of Agriculture, a report on the form provided, showing the average progress yields of each herd in the Sub-unit.

24. For the purpose of compiling official records, the lactation period shall commence on the seventh day after calving and be completed on the 273rd day after commencement.

25. In the case of a member commencing to test his herd for the first time, or in cases where it has been impracticable to test any cows until after they have been calved two or more months, such cows may be credited with 60 days' production based upon the first test made by the Testing Officer, unless the owner desires an exemption, which may be granted.

26. In compiling the annual report of the average production of the herd, exemptions may be allowed for such cows as have been sold, or have dried off owing to accident or sickness prior to the third testing period, also for heifers calving under 18 months of age.

27. The Testing Officer shall be provided with food and lodging for himself, and fodder for his horse, free of charge, by the member for whom he is testing during such time as is occupied in testing the member's herd.

WHEAT PRODUCTION COSTS.

Geo. L. Sutton, Director of Agriculture,
and
I. Thomas, Superintendent Wheat Farms.

It is not possible to give a general answer to the question, "What is the production cost of a bushel of wheat?" This is because, on the 10,000 odd farms in Western Australia on which wheat is being produced, it is safe to say that on no two of them are the conditions entirely the same. Even if these farms were classified into groups on which similar conditions obtained, it would be found that there was such a wide range between some of the groups that it would still be impossible to satisfactorily answer this question. It is, however, possible to state definitely that, on the majority of wheat farms and at present prices (2s. 6d. per bushel) wheat farming does not pay, and this at once raises two questions: "Why do wheat growers remain on their holdings?" and "How are they able to do so?"

In answer to the first question, it is pointed out that a farm, in addition to being a place where certain commodities are produced by the farmer for sale, is also a home for his family, where many of their sustenance requirements can be produced at a minimum of expense. Quite apart, therefore, from the difficulty of disposing of a highly capitalised property, there is considerable reluctance to

break up the home, often with its many sentimental associations, whilst there is any reasonable chance of being able to maintain it. This raises the second question, "How is it possible to remain on it?"

It can only be in one or probably both of the following ways:—

(a) By the farmer himself working for a low labour income; and

(b) By failing to make due return for capital invested; in other words by not receiving interest for his own capital invested in the farm, or not paying interest on borrowed capital.

To illustrate these two points it is proposed to consider the details of an assumed case of the simplest character. In this the farm is regarded purely as a commercial unit and any return for the farmer's labour, experience, and administration is excluded from the returns considered. Had they been available it would have been preferable to deal with the accounts of an actual farm, but, because of the difficulty of securing such, and the variation between the conditions and individual farms, the *pro forma* transactions of an extremely simple case, not complicated with stock or other transactions has been assumed. The farm is assumed to be the standard area of 1,000 acres, worked by a six-horse team, and with clearing and cropping details as follows:—

	acres.	acres.
Total area		1,000
Cleared		900
Homestead, shelter belts, accommodation paddocks		100
Disposal of cleared land—Fallow	300	
Crop	300	
Grazing	300	
	900	
Particulars of cropped area—		
Wheat to be stripped for sale	234	
Wheat for seed	16	
Oats—Feed and Seed	10	
Oats for Hay	40	
	300	

For reasonable facilities only the capital expenditure is estimated to be:—

TABLE 1.

CAPITAL EXPENDITURE.

	£
Clearing 900 acres at 25s.	1,125
Fencing—7 miles wire and erection (posts cut on farm)	160
7 horses—6 for team and one spare at £35	245
1 horse (cart) at £25	25
Harness—eight at £5	40
1 spring cart	15
1 cultivating plough (Sundercut 10 disc)	55
1 combined cultivator—drill, 16 run	79
1 reaper and binder, 6ft.	79
1 harvester 8ft.	158
1 waggon—4 ton	87
1 bag loader	2
1 wheat pickler	5
1 engine—6½ h.p.	119
1 chaffcutter, £26, and elevator £11	37
Ironwork for swingle bars	3
Tools	20
2 cows at £15	30
Tank—2,000 yard at 1s. 6d. and cover, £25	175
House	250
	£2,709

Excluding personal expenditure for the farmer's family, and for grain sacks and sewing twine, the annual out-of-pocket expenses are estimated in the table hereunder:—

Table 2.

ANNUAL OUT-OF-POCKET EXPENSES.

(Excluding any remuneration for farmer and costs of wheat sacks and sewing twine. Superphosphate bags to be used for oats.)	£	s.	d.
Super, 300 acres at 90lb. — 12 tons — £54 and freight	60	0	0
Binder twine—12 spools at 4s. 8d.	2	16	0
Repairs and renewals	30	0	0
Copper carbonate at 2 ozs. bus. 26lb. at 1s. 4d.	1	15	0
Sundries	15	0	0
Oils and fuels	10	0	0
Insurance on crop for hail and fire	10	0	0
,, house, fences, etc.	3	0	0
Vermin tax ¼d. in £	1	0	0
Road Board rates	4	0	0
	£137	11	0

From the above it will be seen that, excluding the cost of wheat sacks and twine, the irreducible current expenses amount to £137 11s., say £138, and this is incurred whether the yield is 10 bushels or 30 bushels. The cost of bags is equally an essential current expense but it varies with the yield obtained. This is provided for in the table hereunder, where the cost of sacks per acre is given at yields ranging from 12 to 24 bushels:—

Table 3.

OUT-OF-POCKET EXPENSES.

(*Excluding remuneration for farmer*).

Item.	Yield per acre.											
	12 bus.			15 bus.			18 bus.			21 bus.			24 bus.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Out-of-pocket working expenses (Table 2) ...	138	0	0	138	0	0	138	0	0	138	0	0	138	0	0
Sacks and Twine	38	0	0	47	0	0	56	0	0	65	0	0	74	0	0
Total ... ...£	176	0	0	185	0	0	194	0	0	203	0	0	212	0	0

The above totals are what may be regarded as reasonable irreducible minimum out-of-pocket annual expenditure involved in the production of 12 to 24 bushels, or total productions of from 2,808 bushels to 5,616 bushels.

Assuming the wheat to be sold at 2s. 6d. per bushel at the railway siding the gross returns will range from £351 to £702, leaving balances of from £175 to £490 available to the farmer who has been able to carry out the whole of the work without outside assistance. In many cases additional help will have had to be engaged during the year, and, assuming this to be, say, £39, equivalent to one man for 13 weeks at, say, £3 per week, the balance will be reduced to £136 to £451. These represent the amount available for the sustenance and remuneration of the farmer for overhead charges and profit. In the case of an unencumbered freehold farm

these would be the amounts available for remuneration, depreciation, and interest on capital invested. Ignoring remuneration, which will always be a varying amount according to individual needs and circumstances, it is considered that depreciation is the next item to be provided for, this at 10 per cent. on machinery and 2½ per cent. of permanent improvements, amounts to £79 and reduces the balances to £57 and £372. Interest at 6 per cent. on capital amounts of £162. With a yield of only 12 bushels per acre there is less than £105 to meet this, and, in the case of the 24 bushel yield, the balance is reduced to £210. Provision for the annual Crown rent of £25 would increase the debit balance in one case to £130 and reduce the credit balance in the other to £185.

This item of £25, is the annual instalment which purchasers of Crown Land are required to pay; as it forms part of the purchase money it is really a capital charge, but as it is an amount which has to be met annually by the settler it is now treated as portion of the working expenses. From the standpoint of an accountant such procedure is improper, but wheat production costs on most farms are effected usually beneficially by the interaction of side-line activities. In this simple case the effect of this interaction has not been considered, but having regard to it and to the value of the land for wheat-growing purposes, it is believed that the amount of £25, is a very reasonable annual cost to be charged the cropped land.

In Table 4 are set out these details as they apply to yields from 12 to 24 bushels per acre.

TABLE 4.

WHEAT PRODUCTION COSTS.

Financial results with yield ranging from 12 to 24 bushels per acre.

Item.	Yield per acre.				
	12 bus.	15 bus.	18 bus.	21 bus.	24 bus.
Gross yield (bushels) ...	2,808	3,510	4,212	4,914	5,616
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Gross return at 2s. 6d. per bushel	351 0 0	438 15 0	526 10 0	614 5 0	702 0 0
Out-of-pocket expenses ...	176 0 0	185 0 0	194 0 0	203 0 0	212 0 0
Balance available for farmer's sustenance, extra labour, remuneration, overhead expenses, and profit	175 0 0	253 15 0	332 10 0	411 5 0	490 0 0
Extra assistance	39 0 0	39 0 0	39 0 0	39 0 0	39 0 0
Balance	136 0 0	214 15 0	293 10 0	372 5 0	451 0 0
Deduct—Depreciation ...	79 0 0	79 0 0	79 0 0	79 0 0	79 0 0
Balance	57 0 0	135 15 0	214 10 0	293 5 0	372 0 0
Deduct—Interest	162 0 0	162 0 0	162 0 0	162 0 0	162 0 0
Balance	*105 0 0	*26 5 0	52 10 0	131 5 0	210 0 0
Deduct—Rent	25 0 0	25 0 0	25 0 0	25 0 0	25 0 0
	Dr.	Dr.	Cr.	Cr.	Cr.
Balance	130 0 0	51 5 0	27 10 0	106 5 0	185 0 0

*Debit Balance.

From the above table it will be seen that, when due provision is made for all legitimate charges against the crop, on a farm producing about the average yield for the State, viz., 12 bushels per acre, there is a loss of £130 on the year's transactions, and to this loss must be added an amount necessary for the sustenance of the farmer and his family, and remuneration for his labour. If, however, the farm is unencumbered and no interest to outsiders is due, or if the interest could be met from a sideline, such as wool or lamb production, the farmer would have £32, *i.e.*, £57—rent £25, to purchase commodities for his sustenance. With the pecuniary assistance from sidelines as poultry, dairying, sheep and pigs, often run by members of the family, he might be able to carry on, and in many cases would certainly be able to do so if the amount were increased to £111, as the result of ignoring the amount of £79 reserved for depreciation. To do so, however, would be an extremely short-sighted policy, for machines and implements, even when cared for in the very best possible manner, will wear out and must be replaced.

Even in such a simple case as illustrated, it will be seen that, in order to provide for all legitimate commitments before making provision for the farmer's sustenance it would be necessary to have a yield of approximately 18 bushels per acre. Though our average yield is between 12 and 13 bushels it is believed that such a higher yield is possible on very many farms, but, even in such cases, it would be necessary for the unencumbered farmer to forego his interest and, in the case of encumbered farms for the creditors to forego portion or all of their claims. The importance of the industry to the individual and the State is more than sufficient to justify this whilst waiting for the improvement in price which history indicates will surely come.

In Table 5 hereunder will be found details showing the increased income due to a rise in price of from 1d. per bushel to 6d. per bushel for yields of from 12 to 24 bushels per acre:—

Table 5.

INCREASED INCOME DUE TO RISE IN PRICE PER BUSHEL.

Rate per bushel.	Yield per acre.				
	12 bus.	15 bus.	18 bus.	21 bus.	24 bus.
	£ s. d.	£ s. d.	£ s. n.	£ s. d.	£ s. d.
1d. per bushel	11 14 0	14 12 6	17 11 0	20 9 6	23 8 0
2d. per bushel	23 8 0	29 5 0	35 2 0	40 19 0	46 16 0
3d. per bushel	35 2 0	43 17 6	52 13 0	61 8 6	70 4 0
4d. per bushel	46 16 0	58 10 0	70 4 0	81 18 0	93 12 0
5d. per bushel	58 10 0	73 2 6	87 15 0	102 7 6	117 0 0
6d. per bushel	70 4 0	87 15 0	105 6 0	122 17 0	140 8 0

These figures emphasise the importance of improving our efficiency by increasing the yield per acre, for at the extremes shown, with the same improvement in price, the increased income is double that of the other.

Though our average yield is between 12 and 13 bushels, the results of the District Challenge Shield Competition promoted by the Cuming Smith-Mt. Lyell Farmers' Fertilisers Ltd., indicate that much higher yields can be obtained on many farms. In this competition the yields of the total areas cropped by the competitors were compared. During the course of the competition, which was extended over three years and included farms located over the Wheat Belt from North to South,

the total area harvested in this Competition was 92,498 acres and the average yield obtained was 17 bushels 53 lbs. There is every indication, therefore, that by good farming our average State yield can be increased by from 3 to 6 bushels per acre, and thus place the majority of our farmers in a very much happier financial position than at present.

It may be uregd that it is possible to increase the net income by cropping an additional area per unit. It is admitted that, by the use of larger teams and bigger implements, it may be possible to do this in some cases. In the case of the single-man farm unit it is believed that any advantage so gained would be more than offset by the necessity for, and expense of, more labour, or by the additional expense necessary for household requirements due to the neglect to grow those farm products which are suitable for consumption in the home, and which provide the best, though limited, market for the farmer's labour.

In many cases the actual capital invested will be found to be greater than that assumed, for this latter has been kept down to the minimum compatible with the requirements for efficient working. In this connection it may be pointed out that the larger the capital involved the greater is the need for increased yields, and, if a given capital cannot be justified by the average yield obtained, then such capital, whether it be borrowed, or the farmer's own, must be written down.

In Table 6 hereunder the total production costs, as given in Table 4, of the farm have been reduced to costs per bushel:—

TABLE 6.

WHEAT PRODUCTION COSTS.

Cost per bushel.

Item. Excluding farmer's out-of-pocket expenses, and renumeration—	Yield per acre.				
	12 bus.	15 bus.	18 bus.	21 bus.	24 bus.
	pence.	pence.	pence.	pence.	pence.
Cost per bushel ...	15·05	12·65	11·05	9·92	9·06
Plus outside labour ...	3·33	2·66	2·22	1·91	1·66
	18·38	15·31	13·27	11·83	10·72
Plus Depreciation ...	6·75	5·40	4·50	3·85	3·38
	25·13	20·71	17·77	15·68	14·10
Plus Interest	13·84	11·52	9·12	7·92	6·72
	38·97	32·23	26·89	23·60	20·82
Plus Rent	2·14	1·71	1·42	1·22	1·07
Per bushel	41·11	33·94	28·31	24·82	21·89

From this table it will be seen that, even when the cost of farmer's sustenance and remuneration excluded, with a yield of 12 bushels, approximately the average of the State, it requires nearly 3s. 6d. per bushel to cover all legitimate charges, but this is reduced to almost half this amount when the yield is doubled; again emphasising the tremendous need for improving our yield per acre. Intensive rather than extensive production is, therefore, the dominant need during the present depressed times.

Except possibly on some few very well administered farms, larger than the standard unit, and where very high duty is obtained from each implement and machine used, the financial result of wheatgrowing as a commercial investment is unsatisfactory. Where, however, the farm unit is also the farm home the position is decidedly better. Here the first consideration is, or should be, to provide the household requirements—milk, butter, eggs, meat, bacon, vegetables and fruit, by utilising to the greatest possible extent the facilities of the farm. These will provide a very large part indeed of the sustenance requirments of the farmer and his family, so that the purchased requirements are reduced to a minimum and not amount to a great sum. It is thus possible for a farmer on an unencumbered, or lightly encumbered farm, to retain his home even if the yields are not higher than the State average and the price is low as at present. On a heavily encumbered farm, owing to the interest obligations, the position is more difficult. In such cases it is suggested that, though the details which have been discussed are assumed, the method adopted of dividing the costs into sections is suitable for application to any case by substituting actual figures for the assumed ones; it will then be possible for the farmer to determine what sacrifices it will be necessary to ask his creditors to make in order that he may retain his holding.

AN EARLY STRAIN OF SUBTERRANEAN CLOVER.

By A. B. Adams, B.Sc.Agr.

When looking for suitable areas for seed collection of the variety of Subterranean Clover found on the Northam Golf Course (reported in this "Journal," Vol. 7, 2nd Series, p. 540) it was noted that on one area there was a rather similar type of clover but with a distinct difference in the leaf. Seeds of both types were obtained by the writer and the two varieties were sown, in adjoining rows, in the grass experimental area at Muresk by Dr. Dunne.

There proved to be a difference in time of flowering, as the variety now reported flowered about a fortnight earlier than the strain previously noted.

The two strains may be compared as follows:—

Earlier Strain.	*Later Strain.*
Flowering period commences at end of first or early in second week of August.	Flowering period commences during third or early in fourth week of August.
Calyx tube of flower entirely red.	Calyx tube red in the upper portion, green below.
White crescent-shaped mark in leaflet, no brown flecking below the crescent.	White crescent-shaped mark in leaflet, with distinct brown flecking below the crescent

The variety or strain now reported, is almost as early as the First Early variety, but differs from it as it is a few days later in commencing flowering, is somewhat less hairy, and produces larger leaves on the runners.

It has not been possible to trace the origin of either of the strains found in Northam, but it is probable that they were taken there in the seed of the Mid-season variety. The latter proved unsuited to the conditions, while the two former produced more seed, and as it was produced earlier more of it was buried; therefore they were able not only to persist but to spread.

Note on Length of Growing Period of Subterranean Clover.

The Mid-season and Late varieties remain green for from two to three weeks longer than the Early varieties when grown under similar conditions of soil and climate.

TOMATO CULTURE IN WESTERN AUSTRALIA.

E. T. Morgan, Vegetable Inspector,
Officer-in-Charge Potato Branch.

INTRODUCTION.

The extensive cultivation of the tomato is of comparatively recent years, but it has advanced so rapidly in public estimation that large areas are now planted with this wholesome and delicious fruit or vegetable. With our long warm summer with the mercury sometimes soaring towards 100deg., cold lunches with salad are enjoyed by the majority, the tomato takes its true place, as a salad without tomato is like meat without salt.

From available evidence it appears that the tomato originated in Central South America, and it was known and grown by the natives of Mexico, by whom it was highly prized. Apparently it was not used by Europeans as food for upwards of 100 years after its discovery in America, and it was not until about 1870 that it became recognised universally as an important article of diet. It is now regarded by physicians and dieticians as a valuable source of material necessary to good health and proper nutrition. Prices obtained for tomatoes fluctuate considerably, but remunerative returns are generally obtained for a good article, even during glut periods. The grower who puts on the market soiled, grub-eaten tomatoes cannot hope to secure reasonable returns. It is the careful grower who trains his plants, fertilizes properly, and effectively combats the attacks of insect pests thereby producing a good article, who gets a just reward for his labour.

Prices for early tomatoes are high, and crops harvested in September and October realise anything from £1 to £2 per case. Geraldton and Carnarvon with their early season are first on the market, but quite a large proportion of their crop is exported to the Eastern States where lucrative prices are obtained.

The production of an early crop is an interesting pursuit, as well as a remunerative one, and many growers in the metropolitan area have made large sums of money from relatively small areas. The methods employed are quite simple, but care and attention is necessary to ensure success in this phase of market gardening.

EARLY VARIETIES.

Early large red, commonly known as the crinkled variety, is the most suitable for early cropping. Of the smooth varieties Chalk's Early Jewel and Sparke's Earliana are most popular.

MAIN CROP VARIETIES.

Chalk's Early Jewel, as well as being a popular early variety almost takes pride of place as a main cropper. Matchless, Burwood Prize, Best of All, Stone and Paragon are well tried and suitable varieties. Dwarf Champion is popular with home gardeners. It is a good bearing variety and does not require staking. The skin is of purplish hue, but unfortunately is inclined to crack. The flavour is excellent.

SELECTION OF SEED.

One of the most important factors in the successful culture of tomatoes is the careful selection of seed. There are many strains of the above varieties and the careful grower should endeavour to save the seed from his own plantation, also

great care should be exercised in its selection. Sometimes previous to the first packing, outstanding plants should be marked. This selection should be made on the basis of vigour, freedom from disease, and the amount and quality of the fruit carried by the plant. The fruit should be well coloured, nice sized and firm. A good solid tomato is to be preferred to one having soft flesh. Some growers buy fruit from a neighbour, who has grown a good crop, for the purpose of saving seed. This is the next best method to the above-mentioned selection. Obtain seed from a reliable source, and you will have taken the first right step in the production of the tomato crop.

RAISING OF PLANTS.

The sowing of seed for the early crop may be carried out from April to July, and some means of protecting them from frosts and heavy rains must be adopted. Some growers prepare the seed bed on the lee side of a building, and place stakes around the bed or curved sticks across it, in order to place hessian covers over the plants at night or during heavy cold rains. This is risky, and amongst our most successful growers the usual method is to raise the plants under glass. The initial outlay is rather heavy, but over a number of years the cost entailed is justified, owing to the greater surety of raising plants satisfactorily. Artificial heat is generally necessary, and a very successful and economical way of obtaining this, is by the use of fresh farmyard manure. Horse manure gives best results; cow manure heats too slowly, and poultry manure too rapidly. Horse and cow manure mixed together make a good combination, or if horse manure only is obtainable, it should have about one-third to half its bulk as straw or farm litter. Mix the whole thoroughly together, watering the heap if necessary, and allow to remain for several days until a good heat has generated. Then take the material and form into a heap 2 to 3 feet high. When the heap has been firmed well down, place on it a frame made as follows:—

Take sufficient light timber to make a box frame about 8 feet long by 5 feet wide, or in that proportion. Make the back of the frame about 2 feet 6 inches high and the front, which should be placed facing the sun, about 18 inches. The glass sashes should be placed on top, a beading being put round the edge of the frame in order to hold the glass in place. If glass is unobtainable, hessian may be used as a covering, but this should be fastened to a roller, in order to facilitate the raising and lowering of the cover. The compost heap should be made about 12 inches wider than the frame all round. Seed boxes should then be placed inside the frame. Flat fruit cases are used by the majority of growers and answer the purpose admirably. It is always advisable to obtain unused cases, as if tomatoes have been packed in cases obtained second hand, there is always danger in using them, owing to the likelihood of disease being carried in them, notably Fusarium Wilt. Soil mixed with stable manure should be used, as it is not advisable to use too much artificial manure with soil intended for seed boxes. Smooth the surface and sow the seeds fairly thickly and cover with a shallow dressing of light soil, sand preferred, and water well, using a fine rose on the watering can, or a fine nozzled spray pump. As soon as the seeds germinate, the sashes should be raised to allow of ventilation. Every living thing must have access to fresh air, and every form of life gives off gases, which, if allowed to accumulate, will eventually cause death. Briefly the hot bed should be ventilated every day. The heat of the bed should never be allowed to become excessive, and should not exceed about 70deg. Raising the sashes will cool the bed, and this can be accomplished by placing blocks of wood under the sashes or drawing them back to allow of the circulation of air through the frame. When the plants in the seed box are about two inches high,

they should be pricked out and transplanted into other seed boxes in the frame and spaced 2 to 3 inches each way. This allows of their making sturdy plants and helps to check "damping off," a disease generally associated with over-crowding in the seed bed. It is also advisable to spray the young plants with a weak Bordeaux mixture, using the formula 4:4:100, *i.e.*, 4lbs. of bluestone, 4lbs. of lime, and 100 gallons of water. Commercially prepared forms which are obtainable obviate much time and trouble in this direction. This will tend to check fungal diseases, and the copper solution has a beneficial action on the growth of the plants.

When the plants have attained the height of about 6 inches, they will be ready for transplanting. In order to prepare them to withstand the shock of being moved from the artificial conditions of the hot bed to the more rigorous environment of the open air, the plants should be hardened for a week or more before moving. This is done by gradually lowering the application of water, but sufficient water must be allowed to keep the plants alive and strong.

The ideal method of hardening plants is to have a structure similar to the hot bed frame, which is placed directly on to the ground, provided that the land is sufficiently well drained to allow of the free escape of excess water. The plants in the seed boxes should be placed in this, and can be gradually hardened more effectively than by any other method.

RAISING OF PLANTS FOR THE MAIN CROP.

The seed for the main crop may be planted in the open, when danger of frost is over, generally about September and October. The soil is gradually warming up at this period, and if a fairly sheltered spot is picked no difficulty will be experienced in the raising of plants. In some localities slight frosts are experienced during the above months, hence the necessity, in those parts, of choosing a sheltered position. If, by any chance, plants in the bed suffer from the effects of frost, watering with cold water before the sun's rays strike them will generally save them, as this allows of the gradual thawing of the ice particles and enables the cell sap to be re-absorbed by the plants. It is the quick thawing of the ice particles that causes the death of the plants, owing to their being unable to re-absorb the sap which has been drawn away from the plant cells by the process of freezing.

The soil of the seed beds should be worked into a fine tilth and about 3 feet wide, leaving a narrow path between, to allow of watering and cultivation. The seeds should not be sown too thickly, there should be from 1 to 2 inches between plants. This width enables them to become desirable and stocky plants. The beds should be kept free from weeds, and watered sufficiently to keep up a good growth. If at any time the plants are not thriving, watering with a solution of sulphate of ammonia (a large handful to four gallons of water) will encourage growth, but care should be taken not to apply this stimulant directly on to the foliage, but if unavoidable, it should be immediately washed off.

Seed beds are generally made on old cultivated land, and it is a wise plan to fumigate them in order to make sure that certain diseases are not lying in wait for the young plants. Fumigation is carried out quite simply, on a small area, and is resorted to by many of our most successful growers.

The method usually adopted is as follows:—Using a formalin solution (1 part of formalin to 50 parts of water) the ground should be saturated at the rate of half a gallon per square foot, and covered with bags for one or two days. The bags are then removed, the ground is redug, and left open for two days to allow the fumes to escape. The land is then levelled off and the seeds planted about half an inch deep, in rows about 6 inches apart.

SELECTION OF SOIL.

The ideal soil for the production of the tomato crop is a good sandy loam which can be easily cultivated, thereby retaining moisture. For the early crop, land with a northerly aspect, which is in a warm situation, is the most suitable. Although a sandy loam is desirable, tomatoes are grown on many different classes of soil, but where the land is of a clayey nature, drainage must be provided, also cultivation must be carried out at the proper time, as the working of these soils in a wet condition tends to make the surface bake and crack when subjected to warm dry weather, and moisture is therefore lost. However, when well and properly cultivated much of this type of land is producing good crops. The rich gully land of the hills and the river flats of the South-West are ideal spots for tomato culture. The border land of our peaty swamps is excellent for the growing of early crops, and the swamps have proved themselves to be ideal for the cultivation of the late crop. The Geraldton and Carnarvon districts, with their early season, are favourite tomato growing areas and the acreage is being increased yearly.

DRAINAGE.

Many of our tomato growing localities do not require draining. This is generally the case with the border land of our swamps and on sandy loams with a free subsoil, but where there is excess moisture this prevents aeration, keeps down temperature, and retards plant growth. Soil warmth is greatly increased by proper drainage and this is an important feature when dealing with the production of an early crop. Also, well drained land is workable earlier than one which is in a sodden condition.

IRRIGATION.

The early crop, except in very light porous soils, seldom requires watering as sufficient rain usually falls to see the crop through. If the soil dries out, water must be applied. Water may be supplied by means of furrows or drains, and overhead sprinklers. Overhead sprinkling is the most satisfactory method, and where this system is utilised a very even distribution of water is possible. Where irrigation is practised by means of furrows, great care must be exercised in its application, as too much water is just as detrimental to the growth of the plants as is too little. On well graded land, however, watering is satisfactorily done by this method.

MANURING.

No crop responds more readily to correct manurial treatment than does the tomato. In order that plants may develop and mature normally, ten essential plant foods are necessary. Fortunately for us, most of these elements are contained in our agricultural soils and it is generally only necessary to supply phosphates, potash and nitrogen to ensure good results. These three plant foods must be balanced, as it is impossible for an excess of one constituent to make up for the lack of another. Each plant food ingredient has a duty of its own to perform. Briefly stated, the functions of the main plant foods as stated above are:—

NITROGEN.

Nitrogen promotes the vegetative growth of the plant. Excess of nitrogen with sufficient moisture, tends to make top growth, often to the detriment of the fruiting of the plant. A deficiency of nitrogen is seen in the general stunting of the plants and a yellowing of the foliage. The commonest form of nitrogenous fertiliser used by growers in this State is sulphate of ammonia. It is very soluble in water, therefore is quick acting. Nitrogenous manures, judiciously used, maintains growth at its maximum, without affecting the fruit-bearing qualities.

PHOSPHATES.

Phosphates have important functions to fulfil, particularly the stimulation of root development, whereby a vigorous root system is produced. They also stimulate the flowering system of the plant and hasten ripening. Superphosphate and bonedust are the most generally used phosphatic fertilisers.

POTASH.

Potash is an important constituent for plants which produce mainly carbohydrates, such as starch and sugar. It influences to a great degree the health and growth of plants. Plants are said to be more resistant to disease when well supplied with potash. Potash improves the carrying as well as the eating qualities of the fruit, besides increasing the proportion of marketable produce in the tomato crop. Sulphate of potash is the most generally used potassic fertiliser in this State.

Fertilising, therefore, should be done with a well balanced mixture, and where stable manure is obtainable, this commodity, in conjunction with a dressing of artificial manure, will maintain good growth and produce a satisfactory crop. Where stable manure is not procurable, the ploughing in of green stuff will furnish humus so necessary to our soils. As the tomato plant continues fruiting over a rather lengthy period it is a wise plan to fertilise with artificial mixtures at intervals rather than to apply a heavy dressing at the time of planting out. Mixtures that have been found to give satisfactory results are Mount Lyell No. 4, Cuming Smith "E" Brand, and Cresco special potato manure. Blood and bone manure is used by many of our market gardeners with good results, but as the phosphoric acid contained in this mixture is only slowly available, the addition of superphosphate is beneficial. A mixture of four parts blood and bone, two parts of superphosphate, and one part of sulphate of potash is recommended as a good combination for many vegetable crops, and for tomatoes has produced fine crops. It is suggested that from 15 to 16 cwts. is applied per acre, although many growers use a ton or more per acre with increasingly good results. If half the quantity per acre is applied at the time of planting and the other half when the plants carry their first flowers, the results should be most gratifying.

Stable manure may be broadcast and ploughed in prior to planting out, or may be applied in the holes excavated for the reception of the plants, mixing the manure, together with the artificial fertiliser, well with the soil.

Heavy dressings of nitrogenous fertilisers are not advised for the tomato, as rank top growth may be induced to the detriment of the fruiting qualities of the plant. Heavy top growth is not generally conducive to good fruit setting. Where plants have been bearing heavily, a dressing with a nitrogenous fertiliser is beneficial and will prolong the growth of the plant with increased fruit production. Sulphate of ammonia applied near the plant and watered in, if dry weather is experienced, is recommended, or as a liquid manure, a large handful in a kerosene tin of water should be applied round the base of the plant, not allowing it to come in direct contact with the foliage or slight burning may take place.

TRANSPLANTING.

When the plants have attained a height of from six to eight inches, they are ready to be removed to their permanent position. As the plants for the early crops are planted out in the beginning of winter, it is advisable to put the land up in ridges in order to facilitate drainage. The land to be utilised having been thoroughly worked, ridges are quite easily struck out with the plough. Manuring may be done at the time of ploughing. It is suggested that a furrow is ploughed each

way along the line to be planted, which should be marked out with sticks prior to the commencement of operations, allowing about three feet between the rows, so as to leave a V-shaped channel. The manure may be sown along this furrow. If the

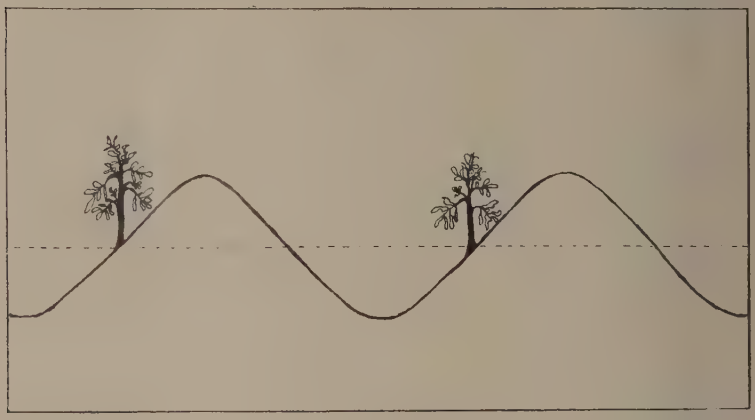
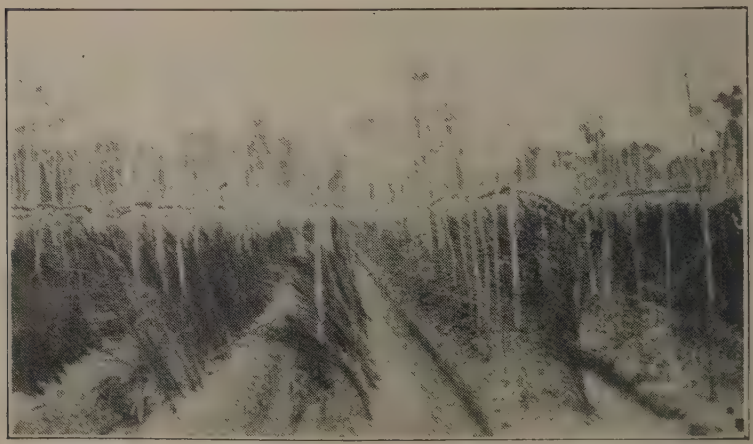


Fig. 1.

depth of ploughing is then increased and the furrows are ploughed back to form a ridge, the results will be a row ready for the putting out of the young plants. The young plants, when removed from the seed bed, should have their roots kept moist and protected from the effects of drying winds, if such obtain at the time of planting. The plants should be placed on the side of the ridge (as illustrated) instead of on the top—the earth at the back making for the protection of the young plants during stress of weather. Later, when the weather becomes warmer, the

Fig. 2.



Early Tomatoes staked and sheltered with palm tops.

whole of the land may be levelled, this process being done without disturbing the root system, so leaving the soil well and deeply worked, and enabling the plants to maintain a regular and healthy growth.

CULTIVATION.

Cultivation should be carried out systematically in order to conserve moisture, aerate the soil and keep down weeds. No hard and fast rule can be laid down as to the number of cultivations necessary. This the grower will decide for himself. Where the land has been well prepared and the soil moisture has been maintained by thorough cultivation, there is seldom any necessity for irrigation in the growing of the early crop, but where irrigation has been done the land should be cultivated after each watering in order to maintain a fine surface mulch and to avoid baking and cracking of the soil.

SPACING.

No hard and fast rule can be laid down as to the distance apart that the plants shall be spaced. This depends a lot on the variety, district and time of planting. When the plants are staked and pruned it is usual to space the rows 3 to 4 feet apart, with the plants about 18 inches to 2 feet apart in the row. This will give ample room to allow of cultivation beween he rows. A width favoured by many growers is 3 feet apart each way. This width allows for good growth of the plant without crowding, and permits cultivations and spraying.

PRUNING.

In order to obtain the best results, tomato plants should be systematically pruned. Pruning often takes place in the seed-bed, as when plants are weak and spindly, pinching out the terminal bud will produce a more stocky and vigorous plant.

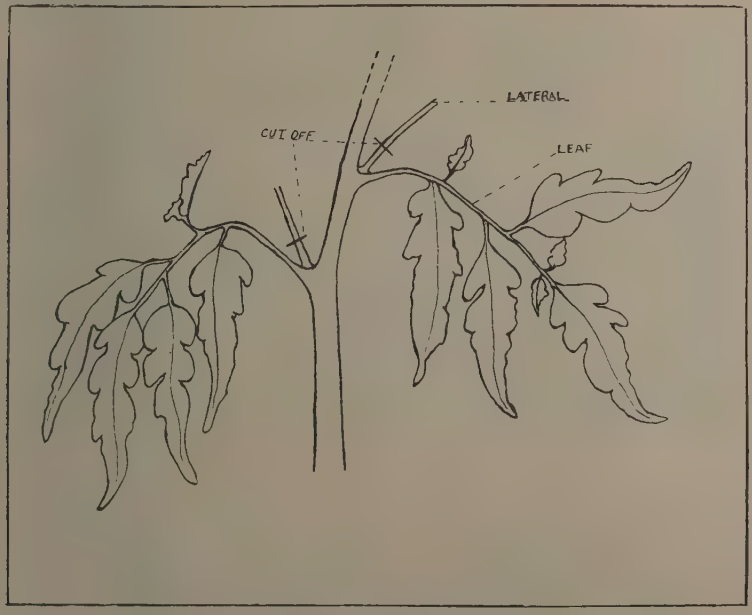


Fig. 3.

The main pruning is done when the plants are put out in their permanent positions, and consists of pinching out the superfluous laterals that start from the axil of the leaves in the main stem or stems (See Fig. 3.)

When the plants are staked, they are usually pruned to a single stem, which is topped when it reaches the top of the stake to which it is tied. The whole energy of the plant is then directed to the production of fruit, but sufficient foliage must be allowed to remain in order to allow of proper assimilation and to protect the fruit from sunburn. Pruning is recommended for the early crop, but the late crop is seldom treated as the hot sun tends to burn the fruit, but some pruning can be done with beneficial results, as the checking of excessive leaf growth encourages fruit production.

TRELLISING.

To obtain the best results, tomato plants should have some kind of support. To allow the plants to roam all over the ground, with the likelihood of the fruit getting dirty and worm eaten, is bad business; rot is encouraged by the fruit lying on the damp ground, cultivation is interfered with, and picking and spraying for the control of insect pests are rendered difficult.

Several methods of support are adopted by growers. Mulching with straw or other litter between the rows is carried out. This method certainly keeps the fruit off the ground, but better results are obtained by staking. Trellising may be carried out by running wires between posts placed at either end, one wire about 2 feet

Fig. 4.

Tomatoes, pruned and trellised.

from the ground, and the other about 18 inches or 2 feet above this, a stake being placed near each plant, so that the main stem may be tied as growth proceeds. Another method is to build a framework with light saplings on the same principle. This is adopted by at least two of our most successful growers in the Balcatta district.

Another method of support, largely adopted in the metropolitan area, is to place four stakes about 4 or 5 feet long around each plant; strips of bagging about 1½ inches wide are fastened round the stakes at about a foot from the ground, and, as growth continues, further strips are used higher up the stakes. It is not advisable to have the stakes too close in to the plant, or the tendency will be for the plants to be bunched too much, and not allowed sufficient sunlight to enable the plant to do of its best and mature its fruit.

GATHERING AND MARKETING.

The exact stage of ripeness at which the fruit is gathered depends on the market to which it has to be sent and the time occupied in the transit thereto. In no case, however, should the fruit be picked until it has fully developed, which does not mean that it is showing colour, but that the pulp surrounding the seeds has filled the inside cells of the fruit and is becoming jelly-like.

In most varieties there is a slight fading of the dark green colour of the skin at the apex of the fruit, as well as slight browning at the point at which the fruit is attached to the stem. If gathered at an earlier stage the flavour will never be fully developed. Gathered at this stage it can be sent to distant markets without difficulty, but where the market is close, the fruit may be allowed to become coloured before being picked. As the fruit, once it has become fully developed, matures rapidly, it is necessary to go over the plants frequently, as if this is not done a quantity of the fruit is apt to become over-ripe and unsuitable for market.

The produce should be handled carefully and all badly blemished or diseased fruit discarded. These should not, however, be left lying on the ground, but should be destroyed, as diseased fruit lying about may be the means of spreading disease throughout the garden.

The sound fruit is taken to the packing shed, where it is graded and packed, usually in cases containing three-quarters of a bushel. Grading should be done on the basis of colour as well as size. It is a mistake to pack green and coloured fruit in one case; if each is placed in a separate case better prices will generally be realised.

BACON CURING ON THE FARM.

By G. K. Baron-Hay.

It is not proposed to deal here with the methods and appliances employed in the curing of bacon on a large scale, but to endeavour to explain the principles and methods applicable to the curing of bacon by individual farmers or householders.

PIGS SUITABLE FOR BACON.

It is essential that pigs for slaughter should be in perfect health. Fortunately the incidence of the two most common diseases amongst pigs, namely, tuberculosis and swine plague, is extremely low. The latter can be easily recognised by external symptoms and the pig exhibits obvious signs of disease. Tuberculosis, however, may be present although not detectable in the live pig, but a useful rule is never to kill an animal for consumption that is losing weight.

Pigs should not be driven hard or excited prior to slaughter, as the flesh is toughened and may not cure satisfactorily.

The best class of bacon is obtained only from young pigs, ranging from 6 to 8 months old, weighing from 140 to 180 lbs. live weight, equal to 105 to 135 dead weight.

SLAUGHTERING.

Farm bacon should be made during the cool months of the year, temperatures higher than 60deg. F. during the day being undesirable. These conditions are found usually from June to September in Western Australia generally, but until November in the South-West coastal areas.

Before slaughtering pigs should be quietly driven into a pen and starved for 24-36 hours, but should have access to plenty of clean water.

The pig should be stunned by a smart blow with a long-handled hammer or back of an axe. The pig is then held on its back or hung by a rear leg and stuck, by inserting a long knife in the throat, immediately in front of the breast bone, with the point towards the tail, and firmly forcing in line with the backbone for 6-8 inches. The blade is then turned completely round and withdrawn. This severs the arteries on both sides, near the windpipe, the blood spurting out.

It is essential that bleeding should be completed, and struggling assists in this object; the pig, however, being unconscious, feels no pain.

SCALDING.

A tub or wooden vat is desirable in which the whole pig can be immersed, but if this is impossible, scalding water may be poured over portions of the pig, these being scraped immediately. The job, under these circumstances, is a tedious one.

The temperature of the water should be from 165-175deg. Fah. It is desirable to use a thermometer to ascertain the temperature of the scalding water, as too hot or too cold will not loosen the bristles.

If wholly immersed, the carcase should be kept moving in order to obtain an even colour of the skin and avoid reddened patches after scraping. After soaking for several minutes, and the hair by test is found to be readily detached, scraping may be proceeded with. In factories scraping is carried out in the tub, but on farms it is preferable to lay on a suitable bench, a convenient form being that of a grid placed over the vat. When scraping start with the head and feet. See that the nose, ears, and feet are made sweet and clean. Finally wash down and remove patches of remaining hairs and scurf with a sharp knife. Should the hair not scrape off easily in certain areas, further applications of hot water should be made. The toenails can be easily pulled off by inserting a hook just above the hoof.

The carcase should finally be washed with clean cold water, and hung by inserting a gambrel through each hock.

CUTTING AND CLEANING.

With a sharp knife cut around the tail and back passage to release from the surrounding tissue. The ventral surface should then be cut through from the tail, along the centre of the belly to the jaw, taking care not to cut any of the internal organs. The breast bone should be cut or sawn through. Grasp the intestines just below the bladder, releasing the back passage if necessary, drawing them forwards and downwards, which will expose the kidneys attached to the backbone.

By cutting at the rear of the cavity just under the kidneys and then around the diaphragm or partition retaining the intestines, the whole of the entrails can be pulled forward out of the carcase, including the intestines, spleen, liver, stomach, heart and lungs, cutting down along the gullet and windpipe to the tongue.

A spreader 9in.-12in. long should be inserted in the flanks to keep the carcase open for cooling, washing and draining. The jaws may similiarly be opened by a piece of pointed stick about 6-8in. long.

The carcase is well washed with clean cold water, rough edges trimmed off, and hung to cool and dry in a dust-free, clean atmosphere for 24 hours.

CUTTING UP.

When the carcase is firm and set, cutting up may be carried out—either while hanging or on a table. The head and trotters are first removed, the former by cutting all round the neck deeply, just behind the ears, force being applied to screw the head off the spinal column.

A deep cut should now be made through the back skin and flesh, close to the backbone, right from tail to end of neck. The ribs are then sawn from each side of the backbone. If these operations have been carried out with the carcase hanging, the sides are now placed flat on a table or bench, insides exposed.

The mesentery or leaf lard can now be removed, commencing near the flank, taking away the kidneys with the lard fat.

Trim the sides all round, removing rough edges of bone, blood and stained pieces. If it be intended to cure the complete side, no further dressing or cutting is required.

The ham may be removed if desired, however, by cutting in a slightly circular shape, commencing at the flank, detaching it from the midde piece or flitch.

The shoulder can be removed by cutting through the side between the fourth and fifth rib.

BACON-CURING.

This should be conducted only during the cooler months of the year, as it is important that as constant a temperature as possible should prevail and that this should not exceed 60deg. F. Lower temperatures and a humid atmosphere are preferable, but these cannot always be obtained on farms, large establishments working at temperatures varying from 40deg.-50deg. Fah.

A cellar makes a good curing room, being cool and moist, and the absence of light prevents bleaching of the red meat.

Bacon may be cured either by the dry method or by pickling in various liquids.

MORDANT FOR FIXING THE COLOUR.

Immediately after cutting up and trimming, the surface flesh should be dusted over with equal parts of fine salt and finely ground saltpetre (potassium nitrate). Only a light dusting is required, which should be allowed to remain for 24 hours, and then washed off.

DRY CURING.

Various recipes are in use for a curing mixture, common salt being the main constituent in all. The use of common salt alone has a hardening effect on meat, and also causes the natural flesh colour to fade, lessening the attractiveness of the bacon.

To correct the hardening influence of common salt brown sugar is commonly used in varying proportions. It also adds brightness, and increases the juiciness and flavour, the sugar also acting as a mild antiseptic.

Saltpetre is usually added in small quantities to preserve the colour. If too much is added the natural colour of the meat is changed to a deep brown, which turns a grey colour on cooking.

The following recipe is recommended by the Hawkesbury Agricultural College, New South Wales:—

Fine dry dairy salt—50 parts by weight.
Brown sugar—5 parts by weight.
Saltpetre, powdered—2 parts by weight.

The mixture should be stored in the curing room for several days prior to use, so as to be the same temperature as the meat.

For the first three or four days after the colour-fixing mordant has been washed off, the above mixture should be rubbed lightly over the fleshy parts and packed round the bones and joints. After the first 3-4 days, the mixture should be spread freely over the sides every 3-4 days, the sides being stacked, and their position in the stack reversed at each handling. The time required for curing is about 14 days.

PICKLING.

Practically every bacon curer has a private recipe for making the pickle; the following, however, can be recommended:—

Clear rain water—10 gallons.
Fine dry dairy salt—25 lbs.
Brown sugar—2½ lbs.
Saltpetre—1 lb.
Allspice—¼ lb.

The quantities given are sufficient for 250 lbs. of meat.

Dissolve the salt, sugar and saltpetre in the water, and immerse the allspice tied up in a calico bag. Boil for one hour and skim off any frothy matter rising to the surface during boiling. Allow solution to cool before use. The sides should be rubbed with salt for two to three days before being placed in the pickle. The time required to pickle varies with the size of the sides, but is usually about three weeks.

SMOKING.

After dry cleaning or pickling, the sides are brushed, any loose pieces of meat cut off, and the meat placed in a vat of cold water containing bicarbonate of soda (1 lb. to every 20 gallons of water) for 24 hours. Remove and wash in a bath of tepid water (blood heat).

The meat is now hung in a clean dry place, in a draught, if possible, until thoroughly dry. It is most important that the meat shall be perfectly dry before smoking is commenced.

Smoking should be carried out in some device which surrounds the flesh with a dense smoke, but without heat. Jarrah sawdust, with a few green twigs or leave amongst it makes a cool fire with ample smoke. The temperature should not rise above 90 deg. F., otherwise the fat will melt and run away from the meat.

Smoking may occupy from one to three days, and is stopped when a light brown or tan colour is obtained. The bacon should be allowed to cool down before being handled. The sides may be given a pleasing appearance by rubbing the skin and flesh with pure olive oil.

In order to keep flies and other pests away during storage the surface may be sprinkled with black pepper or a mixture of black and cayenne pepper.

References—Potts, H. W., "Pigs and Their Management."

FERTILISERS.

N. DAVENPORT, Inspector of Fertilisers.

Provision is made under "The Fertilisers Act, 1928," for the publication of the list of fertilisers registered in this State for each current fertiliser year, which commences on 1st November. The appended table shows the registrations effected up to 30th November of this year.

From the retail prices per ton and the registered percentages of the various fertilising ingredients present in the fertilisers, the unit values for the different forms of nitrogen, phosphoric acid and potash have been calculated, and are shown below together with those for 1931 and 1932 for comparison.

These prices show very little variation from last year's figures. The most noticeable difference is the increased price of potash both in the sulphate and muriate form, the respective increase being 1s. 1d. and 11d. per unit. These increases are due in the main to varying rates of exchange between the Continent, where these fertilisers are obtained, and London and Australia.

There has been a substantial fall of 1s. 6d. in the price of nitrogen in the ammonia form resulting from improved methods of manufacture and keen competition in the trade.

UNIT VALUES.

	1931.	1932.	1933.
	s. d.	s. d.	s.d.
NITROGEN (N), as—			
Blood and Bone, Bonedust, and Bone and Flesh	32 0	24 0	24 0
Nitrate	20 0	20 3	19 10
Ammonia	12 8	12 6	11 0
PHOSPHORIC ACID (P_2O_5), as—			
Water soluble	4 1	4 2	4 2
Citrate soluble	4 1	4 2	4 2
Acid soluble in—			
Bonedust	...	6 6	6 6
Blood and Bone and other animal Fertilisers	6 6	5 6	5 6
Basic Phosphate	...	5 6	5 6
Superphosphate and Rock Phosphate	2 6	2 6	2 6
POTASH (K_2O), as—			
Sulphate	6 0	7 4	8 5
Muriate	4 11	5 8	6 7

FERTILISERS.

The following Fertilisers have been registered at the Department of Agriculture, under "The Fertilisers Act, 1928," for the year commenced 1st November, 1932:—

Name of Fertiliser.	Firm.	Brand.	Fertilising Ingredients.										Price per ton on rails at Works or Perth.
			Nitrogen (N), as—				Phosphoric Acid (P_2O_5) as				Potash (K_2O) as		
			Nitrate.	Ammonia.	Blood and Bone.	Bone.	Water sol.	Citrate sol.	Acid sol.	Total.	Sulphate.	Muriate.	
			%	%	%	%	%	%	%	%	%	%	£ s. d.
A.—MINERAL.													
Nitrogenous—													
(a) Nitrogen as Nitrate:													
Nitrate of Soda ...	Cuming Smith, Mt. Lyell F.F., Ltd.	Sickle	15·5	...	...	...	...	...	...	...	...	...	15 4 0
Do. do. ...	do. do. ...	ML in diamond	15·5	...	...	...	...	...	...	...	...	...	15 4 0
Do. do. ...	do. do. ...	CSML	15·5	...	...	...	...	...	...	...	...	...	15 4 0
Do. do. ...	Cresco Fertilisers (W.A.), Ltd.	Cresco ...	15·0	...	...	...	...	...	...	...	...	...	15 14 0
(b) Nitrogen as Ammonia:													
Sulphate of Ammonia ...	Cuming Smith, Mt. Lyell F.F., Ltd.	Sickle	...	20·5	...	...	...	...	...	...	...	...	11 2 0
Do. do. ...	do. do. ...	ML in diamond	...	20·5	...	...	...	...	...	...	...	...	11 2 0
Do. do. ...	do. do. ...	CSML	...	20·5	...	...	...	...	...	...	...	...	11 2 0
Do. do. ...	Cresco Fertilisers (W.A.), Ltd.	Cresco ...	...	20·5	...	...	...	...	...	...	...	...	11 7 6
Phosphatic—													
(a) Rock Phosphates:													
Pacific Islands Phosphate	Cuming Smith, Mt. Lyell F.F., Ltd.	Sickle	...	...	...	...	...	...	36·65	36·65	...	...	4 10 0
Do. do. ...	do. do. ...	ML in diamond	...	...	...	...	...	...	36·65	36·65	...	...	4 10 0
Do. do. ...	do. do. ...	CSML ...	...	...	...	...	...	...	36·65	36·65	...	...	4 10 0
Phosphate Powder ...	Cresco Fertilisers (W.A.), Ltd.	Cresco ...	...	...	...	...	...	...	34·80	34·80	...	...	4 10 0
(b) Superphosphates:													
Florida Super 22% ..	Cuming Smith, Mt. Lyell F.F., Ltd.	Sickle	...	...	...	...	20·5	·5	1·0	22·0	...	...	4 10 0
Superphosphate 22% ...	do. do. ...	ML in diamond	...	...	...	...	20·5	·5	1·0	22·0	...	...	4 10 0
Do. do. ...	do. do. ...	CSML	...	...	...	...	20·5	·5	1·0	22·0	...	...	4 15 0
22 Super	Cresco Fertilisers (W.A.). Ltd.	Cresco ...	...	...	...	...	20·5	·5	1·0	22·0	...	...	4 15 0
Florida Super 24% ...	Cuming Smith, Mt. Lyell F.F., Ltd.	Sickle	...	...	...	...	22·0	·5	1·5	24·0	...	...	4 15 0
Super 24%	do. do. ...	ML in diamond	...	...	...	...	22·0	·5	1·5	24·0	...	...	4 15 0
Do.	do. do. ...	CSML	...	...	...	...	22·0	·5	1·5	24·0	...	...	4 15 0

24 Super	Cresco Fertilisers (W.A.), Ltd.	Cresco	...	...	...	...	22·0	·5	1·5	24·0	...	...	5 0 0
46 Super	do. do. ...	do.	...	...	...	...	46·0	...	...	46·0	...	...	11 5 0
(c) Rock Phosphate and Superphosphate :													
Phosphate Mixture 50/50	Cuming Smith, Mt. Lyell F.F., Ltd.	Sickle	...	...	...	...	10·0	1·0	18·0	29·0	...	...	4 11 6
Do. do. ...	do. do. ...	ML in diamond	...	...	...	...	10·0	1·0	18·0	29·0	...	...	4 11 6
Do. do. ...	do. do. ...	CSML	...	...	...	...	10·0	1·0	18·0	29·0	...	...	4 11 6
50/50 Phosphate ...	Cresco Fertilisers (W.A.), Ltd.	Cresco ...	...	...	...	...	9·16	1·84	17·4	28·4	...	...	5 0 0
(d) Basic Phosphate :													
Basic Phosphate ...	Cuming Smith, Mt. Lyell F.F., Ltd.	Sickle	...	...	...	...	...	...	17·0	17·0	...	...	4 14 0
Do.	do. do. ...	ML in diamond	...	...	...	...	...	...	17·0	17·0	...	...	4 14 0
Do.	do. do. ...	CSML	...	...	...	...	...	...	17·0	17·0	...	...	4 14 0
Potassic—													
(a) Potash as Sulphate :													
Sulphate of Potash ...	Cuming Smith, Mt. Lyell F.F., Ltd.	Sickle	...	...	...	...	...	...	...	...	48·6	...	20 11 6
Do. do. ...	do. do. ...	ML in diamond	...	...	...	...	....	...	...	...	48·6	...	20 11 6
Do. do. ...	do. do. ...	CSML	...	...	...	...	...	...	...	...	48·6	...	20 11 6
Do. do. ...	Cresco Fertilisers (W.A.), Ltd.	Cresco ...	...	...	...	...	...	...	...	...	48·5	...	20 0 0
(b) Potash as Muriate :													
Muriate of Potash ...	Cuming Smith, Mt. Lyell F.F., Ltd.	Sickle	...	...	...	...	...	...	...	...	...	50·0	16 11 6
Do. do. ...	do. do. ...	ML in diamond	...	...	...	...	...	...	...	...	...	50·0	16 11 6
Do. do. ...	do. do. ...	CSML	...	...	...	...	...	...	...	...	...	50·0	16 11 6
Do. do. ...	Cresco Fertilisers (W.A.), Ltd.	Cresco ...	...	...	...	...	...	...	...	...	...	50·0	16 5 0
30% Potash Salts ...	do. do. ...	do.	...	...	...	...	...	...	...	...	...	30·0	8 10 0
Nitrogen and Phosphoric Acid—													
Ammonia and Phosphate ...	Cresco Fertilisers (W.A.), Ltd.	Cresco ...	...	...	2·0	...	...	8·30	1·60	15·70	25·60	...	...	6 5 0
Super and Ammonia ...	do. do. ...	do.	...	...	5·0	...	...	15·37	...	1 13	16·50	...	...	7 2 6
Super and Ammonia No. 1 ...	Cuming Smith, Mt. Lyell F.F., Ltd.	Sickle	...	...	1·5	...	...	16·00	·40	2·10	18·50	...	...	5 9 0
Do. do. do. ...	do. do. ...	ML in diamond	...	...	1·5	...	...	16·00	·40	2·10	18·50	...	...	5 9 0
Do. do. do. ...	do. do. ...	CSML	...	...	1·5	...	...	16·00	·40	2·10	18·50	...	...	5 9 0
Super and Ammonia No. 2 ...	do. do. ...	Sickle	...	...	3·5	...	...	15·00	·40	1·60	17·00	...	...	6 6 6
Do. do. do. ...	do. do. ...	ML in diamond	...	...	3·5	...	...	15·00	·40	1·60	17·00	...	...	6 6 6
Do. do. do. ...	do. do. ...	CSML	...	...	3·5	...	...	15·00	·40	1·60	17·00	...	...	6 6 6
Super and Ammonia No. 3 ...	do. do. ...	Sickle	...	...	6·0	...	...	13·50	·40	1·60	15·50	...	...	7 1 6
Do. do. do. ...	do. do. ...	ML in diamond	...	...	6·0	...	...	13·50	·40	1·60	15·50	...	...	7 1 6
Do. do. do. ...	do. do. ...	CSML	...	...	6·0	...	...	13·50	·40	1·60	15·50	...	...	7 1 6
Potato Manure C	do. do, ...	Sickle	...	...	3·5	...	...	15·00	·40	1·60	17·00	...	...	6 6 6
Potato Manure No. 2 ...	do. do. ...	ML in diamond	...	...	3·5	...	...	15·00	·40	1·60	17·00	...	...	6 6 6
Potato Manure C	do. do. ...	CSML	...	...	3·5	...	...	15·00	·40	1·60	17·00	...	...	6 6 6
Potato Manure F	do. do. ...	Sickle	...	...	6·0	...	...	13·50	·40	1·60	15·50	...	...	7 1 6
Potato Manure No. 6 ...	do. do. ...	ML in diamond	...	...	6·0	...	...	13·50	·40	1·60	15·50	...	...	7 1 6
Potato Manure F	do. do. ...	CSML	...	...	6·0	...	...	13·50	·40	1·60	15·50	...	...	7 1 6

FERTILISERS—*continued.*

Name of Fertiliser.	Firm.	Brand.	Fertilising Ingredients.										Price per ton on rails at Works or Perth.
			Nitrogen (N). as—				Phosphoric Acid (P_2O_5) as				Potash (K_2O) as		
			Nitrate.	Ammonia.	Blood and Bone.	Bone.	Water sol.	Citrate sol.	Acid sol.	Total.	Sulphate.	Muriate.	
			%	%	%	%	%	%	%	%	%	%	£ s. d.
Nitrogen, Phosphoric Acid, and Potash—													
Potato Manure B	Cuming Smith, Mt. Lyell F.F., Ltd.	Sickle	...	3·75	...	...	14·50	·35	·75	15·60	4·5	...	7 16 6
Potato Manure No. 3 ...	do. do. ...	ML in diamond	...	3·75	...	...	14·50	·35	·75	15·60	4·5	...	7 16 6
Potato Manure B ...	do. do ...	CSML	...	3·75	...	...	14·50	·35	·75	15·60	4·5	...	7 16 6
Potato Manure E	do. do. ...	Sickle	...	3·50	...	...	14·00	·30	·70	15·00	8·0	...	8 16 6
Potato Manure No. 4 ...	do. do. ...	ML in diamond	...	3·50	...	...	14·00	·30	·70	15·00	8·0	...	8 16 6
Potato Manure E	do. do. ...	CSML	...	3·50	...	...	14·00	·30	·70	15·00	8·0	...	8 16 6
Potato Manure G	do. do. ...	Sickle	...	3·50	...	...	10·50	·20	·60	11·30	16·0	...	11 6 6
Potato Manure No. 7 ...	do. do. ...	ML in diamond	...	3·50	...	...	10·50	·20	60	11·30	16·0	...	11 6 6
Potato Manure G	do. do. ...	CSML	...	3·50	...	....	10·50	·20	·60	11·30	16·0	...	11 6 6
Potato Manure H ...	do. do. ...	Sickle	...	4·00	...	...	12·70	·30	·70	13·70	9·0	...	9 1 6
Potato Manure No. 8 ...	do. do. ...	ML in diamond	...	4·00	...	...	12·70	·30	·70	13·70	9·0	...	9 1 6
Potato Manure H	do. do. ...	CSML	...	4·00	...	...	12·70	·30	·70	13·70	9·0	...	9 1 6
Potato Manure No. 5 ...	do. do. ...	Sickle	...	7·50	...	...	7·00	·20	·40	7·60	13·25	...	11 9 0
Do. do. ...	do. do. ...	ML in diamond	...	7·50	...	...	7·00	·20	·40	7·60	13·25	...	11 9 0
Do. do. ...	do. do. ...	CSML	...	7·50	...	...	7·00	·20	·40	7·60	13·25	...	11 9 0
Orchard Manure	do. do. ...	Sickle	...	2·00	...	...	14·00	·40	1·60	16·00	...	5·0	6 19 0
Do.	do. do. ...	ML in diamond	...	2·00	...	...	14·00	·40	1·60	16·00	...	5·0	6 19 0
Do.	do. do. ...	CSML	...	2·00	...	...	14·00	·40	1·60	16·00	...	5·0	6 19 0
Special Mixture K	do. do. ...	Sickle	...	8·34	...	...	8·40	·20	·40	9·00	...	10·04	10 1 6
Do. do.	do. do. ...	ML in diamond	...	8·34	...	...	8·40	·20	·40	9·00	...	10·04	10 1 6
Do. do.	do. do. ...	CSML	...	8·34	...	...	8·40	·20	·40	9·00	...	10·04	10 1 6
Special Mixture KP... ...	do. do. ...	Sickle	...	6·34	...	...	10·50	·20	·80	11·50	10·04	...	10 1 6
Do. do.	do. do. ...	ML in diamond	...	6·34	...	...	10·50	·20	·80	11·50	10·04	...	10 1 6
Do. do.	do. do. ...	CSML	...	6·34	...	...	10·50	·20	·80	11·50	10·04	...	10 1 6
Tobacco Fertiliser	do. do. ...	Sickle	...	3·30*	...	...	14·00	·50	1·00	15·50	5·70	...	8 2 6
Do. do.	do. do. ...	ML in diamond	...	3·30*	...	...	14·00	·50	1·00	15·50	5·70	...	8 2 6
Do. do.	do. do. ...	CSML	...	3·30*	...	...	14·00	·50	1·00	15·50	5·70	...	8 2 6
Potato Special	Cresco Fertilisers (W.A.), Ltd.	Cresco ...	...	4·00	...	...	12·50	·50	·75	13·75	8·75	...	9 10 0
Potato Manure	do. do. ...	do.	...	1·50	...	...	7·10	1·40	13·50	22·00	7·50	...	7 12 6
Potato Manure No. 2 ...	do. do. ...	do.	...	8·20	...	...	8·20	...	...	8·20	...	10·00	10 10 0
Mixed Manure	do. do. ...	do.	...	1·50	...	...	7·10	1·40	13·50	22·00	7·50	...	7 12 6

Mixed Manure No. 2	do.	do.	do.	2·00	...	...	18·50	...	1·00	17·50	5·00	...	7 12 6
Mixed Manure No. 3	do.	do.	do.	3·00	...	...	14 00	...	...	14·00	6 00	..	8 15 0
Vine Manure	do.	do.	do.	1 50	...	...	7·10	1·40	13 50	22 00	7 50	..	7 12 6
Orchard Manure	do.	do.	do.	1·50	..	..	7 10	1 40	13·50	22 00	7 50	..	7 12 6
Tobacco Manure	do.	do.	do.	3 30*	...	...	14 20	...	1·30	15 50	5·60	..	8 7 6
Miscellaneous—													
Super and Manganese †	do.	do.	do.	...	...	...	17·00	·50	1·00	18 50	...	...	7 15 0
Crushed Sulphur	Cuming Smith F.F., Ltd.	Mt. Lyell	Sickle	...	...	...	...	...	...	...	...	...	18 2 6
Do. do.	do.	do.	ML in diamond	...	...	...	...	...	...	...	...	...	18 2 6
Do. do.	do.	do.	CSML	...	...	...	...	...	...	...	...	...	18 2 6
Sulphate of Iron	do.	do.	Sickle	...	...	...	...	...	...	...	...	...	11 1 6
Do. do.	do.	do.	ML in diamond	...	...	...	...	...	...	...	...	...	11 1 6
Do. do.	do.	do.	CSML	...	...	...	...	...	...	...	...	...	11 1 6
B.—Organic.													
Bone Fertilisers :													
Blood and Bone	Cuming Smith F.F., Ltd.	Mt. Lyell	Sickle	...	...	6·0	...	...	...	12·00	12·00	...	...	10 0 0
Do. do.	do.	do.	ML in diamond	...	...	7·0	...	...	...	9·00	9·00	...	...	10 0 0
Do. do.	do.	do.	CSML	...	...	7·0	...	...	...	9 00	9·00	...	...	10 0 0
Do. do.	Cresco Fertilisers (W.A.), Ltd.		Cresco	...	...	6·0	...	...	...	12 00	12 00	...	...	10 5 0
Do. do.	J. Kitchen & Sons		Apollo	...	...	5·25	...	...	3·00	12·00	15·00	...	...	9 10 0
Do. do.	Haynes & Clements		A1	...	...	5·25	...	...	3·00	9·00	12·00	...	...	11 0 0
Do. do.	Wyndham Meat Works		Wyndham Meat Works	...	...	6·50	...	·09	7·86	3·40	11·45	...	...	10 0 0
Do. do.	W.A. Meat Exports Co.		Eclipse	...	...	6·0	...	...	...	12·00	12·00	...	...	9 15 0
Bonedust :													
Bonedust	Cuming Smith, Mt. Lyell F.F., Ltd.		CSML	...	...	...	3·50	...	...	22·00	22 00	...	...	11 0 0
Do.	W.A. Meat Exports Co.		Eclipse	...	...	...	3·50	...	...	22·00	22·00	...	...	8 5 0
Do.	Henry Wills & Co., Albany		W in diamond	...	...	...	2·75	...	6·00	13·00	19·00	...	...	9 0 0
Do.	Cresco Fertilisers (W.A.), Ltd.		Cresco	...	...	...	3·50	...	...	22·00	22·00	...	...	11 10 0
C.—Mineral and Organic.													
e and Super	Cuming Smith F.F., Ltd.	Mt. Lyell	Sickle	...	...	2·0	...	13·00	·80	4·70	18·50	...	...	7 4 0
Do.	do.	do.	ML in diamond	...	...	2·0	...	13·00	·80	4·70	18·50	...	...	7 4 0
Do	do.	do.	CSML	...	...	2·0	...	13·00	·80	4·70	18·50	...	...	7 4 0
nestic Garden No. 1	W. J. Matthews		Wondergrowth	...	...	3·75‡	...	12·00	·30	3·20	15·50	...	...	§

* Nitrogen partly as nitrate. † Contains Manganese as MnO_2 5.75%. ‡ Nitrogen partly as Ammonia. § Sold in small lots only.

WHEAT—IS IT A SUITABLE FOOD FOR DAIRY COWS?

L. C. Snook, Agricultural Adviser, Dairy Branch.

There exists an unmistakable prejudice against the use of crushed wheat as a food for dairy cattle. As wheat is highly nutritious and is likely to remain a cheap food for some time, it is wise to consider whether this prejudice is justified. Until recent years wheat grain has been too valuable a product to feed to livestock in any quantity, but the question of cost no longer restricts its use. Is there any definite reason why crushed wheat should not become an important food for dairy cows?

A foodstuff, to be satisfactory, must be:—

1. Economical,
2. Nutritious,
3. Palatable,
4. Free from harmful after effects.

Consider crushed wheat under these headings. Perusal of the table of comparative food values on page 559 shows that wheat is undoubtedly an exceedingly cheap foodstuff—it is the cheapest source of carbohydrate on the market and is as cheap a source of protein as linseed meal.

Wheat is a highly nutritious, easily digested, concentrate. It contains between nine and ten per cent. of digestible protein and has an energy value of 72, as compared with oats 60, and bran 50. Wheat grain is rightly considered as one of thet best foodstuffs available.

Crushed wheat is greatly relished by livestock and it often improves the palatability of the whole ration. Crushed wheat should prove an ideal supplement for high producing cows who have to be encouraged to eat to their maximum capacity.

The most important question, however, is whether the feeding of wheat will prove injurious to milking cows. Most farmers are aware of the excellent feeding value, but are dubious about deleterious after-effects.

Two possible evils are anticipated. Some consider that as wheat contains a poisonous principle capable of causing founder in horses, this same substance may also affect the cows. It is very unlikely that trouble will arise from this cause. Henry and Morrison make the following statement. (1) "The germs of the wheat grain contain a substance which is somewhat poisonous when wheat is fed in large quantities, though in the amounts and combination in which wheat is usually fed to dairy cows, there is no trouble from this substance." It should also be remembered that even horses may be fed large quantities of wheat grain with impunity, once they are accustomed to the ration. Sudden changes of diet are always liable to cause digestive disturbances and it would only be common sense to commence feeding wheat in small amounts, gradually increasing the ration to the maximum desired. Where this is done no trouble should be experienced with the reputed toxic substance present in the wheat grain.

An alternative disadvantage has been suggested in that crushed wheat may prove very difficult of digestion, as it tends to aggregate into glutinous masses impermeable to digestive juices and impeding regurgitation (chewing of the cud). This appears a possibility where wheat constitutes the bulk of the concentrate ration and is not fed in conjunction with much roughage. However, interesting experiments carried out in U.S.A. indicate that even under such unusual feeding conditions, trouble from this reason is not likely to occur. The rumen or first stomach of the cow is a very muscular organ capable of quickly disin-

tegrating "boli" or aggregates of sticky food, the food eaten in the bails being quickly mixed with the roughage collected in the field. At Michigan Agricultural Research Station (2) equal parts of linseed meal and ground corn (this mixture when moistened forms a most cohesive mass) were fed to cows which were slaughtered at varying intervals after ingesting the food. The rumens were examined and although no roughage was given and the mixture is considered unusually "heavy" hardly any "boli" remained in the rumen at the end of one hour. This being the case, one can hardly expect that crushed wheat, fed in moderation and with other foodstuffs, would prove unduly tenacious and indigestible when fed to cows.

It has been very difficult to obtain information on the feeding of wheat to cattle, both from text-books and practical farmers. However, the following details have been collected and should prove of interest.

Kellner is the only writer who definitely attributes evil properties to wheat as a cattle food. He states (3) that—"Wheat is also dangerous, being liable to upset the digestive organs—it is best used for fattening cattle and pigs to which it is given ground or crushed."

But if it can be used for fattening cattle why should it prove harmful to milch cows?

Two American investigators, Larson and Putney, hold a different opinion and state (4) "Wheat may be substituted for corn in a dairy ration. It is even a little higher in feeding value. It is altogether a good feed for dairy cows because of its palatability. Use limited only because it is more expensive than corn (maize grain)."

As long ago as 1895 experiments in Denmark (Copenhagen Station) indicated that ground wheat was fully equal to a mixture of barley and oats.

Experiments abroad do not necessarily give a true index of the results which will be obtained in Australia. For this reason the statements of Maynard, the editor of the Australian "Livestock Bulletin," will carry considerable weight with local dairyman. He states (5) "Wheat is used very little in Australia for feeding dairy cows, but the author has used it with satisfactory results when corn was dear and wheat cheap. Dairy farmers can be sure that when wheat is cheap it can be fed profitably to cows."

Endeavour to ellicite definite information from local farmers has proved somewhat unsuccessful. Very few dairymen appear to have fed crushed wheat in sufficient quantities over a lengthy enough period to express an opinion on its value as a cattle food.

Fortunately, Mr. A. P. Herbert, of Nungarin, has been feeding wheat to his stud Jersey cattle for a number of years and has given this Department the benefit of his practical experience. The "Nooka" herd has been officially tested for over two years, hence both production and feeding methods have been checked. Crushed wheat is the basal constituent of Mr. Herbert's concentrate ration, which consists of equal parts of crushed oats, crushed wheat and bran. At various times when bran has been difficult to procure and when the supply of oats has been low, wheat alone has been fed to the cows (along with roughage) without any diminution in the milk yield. As much as eight pounds of crushed wheat has been fed per head per day without any apparent deleterious result. "Nooka" cows under official test have produced remarkably well when tested during the long, dry summer and one must assume that the use of wheat has contributed in no small measure to the success attained. And surely if the use of crushed wheat will result in evil after-effects, Mr. Herbert would have obtained evidence thereof during the long period he has been using this foodstuff.

Wheat has certain distinct characteristics which definitely influence its use as a foodstuff. First and foremost it should be remembered that wheat is a starchy food; it has an abuminoid ratio of 1 : 7 (*i.e.*, the ration of protein to non-protein is as 1 is to 7.) This is too wide a ration for milk production and some protein-rich supplement must be used, except where ample leguminous roughage or grain is available (crushed wheat is a logical concentrate to use in the "clover belt.") Meatmeal should prove an ideal protein food to use in conjunction with wheat. One hundred lbs. of crushed wheat mixed with 10 lbs. of meatmeal would cost about 7s. at current Perth prices. Four lbs. of this mixture, costing about 3d., would, when fed in excess of maintenance requirements, contain ample nutrients to produce one gallon of milk (6). If milk is worth 6d. per gallon it would be profitable to increase the amount of this mixture which is fed as long as one pound of concentrate increases the milk yield by 1½ lb. The only method of determining the profitableness or otherwise of feeding concentrates is to weigh the milk and note the increase which is obtained for the extra food supplied.

The mineral content of wheat should also be noted. Wheat grain is rich in phosphates and its use will tend to eliminate the phosphate deficiency so troublesome in this State. But wheat is also very deficient in lime, a mineral equally essential to lactating animals. Legumes are very rich in lime, this being another reason why they are so valuable as a food for dairy cows. Cattle restricted to a cereal diet require some sort of calcium supplement. Meatmeal contains varying amounts of lime, but not enough to rectify the deficiency of a cereal ration. In the absence of leguminous roughage (clover hay or silage, lucerne, etc.), livestock should receive about 2 per cent. of bone-meal in their concentrate ration, or alternatively, quick lime should be slaked in the drinking water.

One may summarise as follows:—

1. Wheat is at present prices an exceedingly cheap foodstuff; it is nutritious, palatable and easily handled.
2. Where wheat is first used in small quantities, it does not appear that evil effects will follow its use.
3. As much as 8 lbs. of crushed wheat has been fed per day to high producing cows in this State without obvious harmful results.
4. Only use wheat to the extent of a maximum of half the concentrate ration, until experience warrants its use in larger proportions.
5. Wheat is a starchy food with an albuminoid ratio of 1 : 7.
6. Meatmeal appears to be a suitable protein-rich supplement to use in conjunction with crushed wheat.
7. Four pounds of a mixture of crushed wheat (100 parts) and meatmeal (10 parts) contain ample nutrients to produce one gallon of milk, and costs about 3d
8. Wheat is rich in phosphates but deficient in lime. Cows on a cereal diet need some additional supply of lime.

LITERATURE CITED.

(1) Henry & Morrison—"Feeds and Feeding," page 118.
(2) Journal of Agric. Research, May, 1932.
(3) Kellner—"Scientific Feeding of Animals," page 142.
(4) Larson & Putney—"Dairy Cattle Feeding and Management," page 92.
(5) Maynard—"Australian Dairyman's Handbook," page 310.
(6) It is assumed that the production requirement of one gallon of milk is 2½ lbs. of S. Equivalent including half a pound of digestible protein.

THE BLACKBERRY OR BRAMBLE.

(*Rubus fruticosus, L.*)

C. A. Gardner, Government Botanist.

A NOXIOUS WEED.

The Blackberry, or Bramble, is a European plant which has, for many years, been established in the moister situations of the older established parts of the South-West. That it has not become more serious is due to the moisture-requirements of the plant which limit it to such places as stream banks or soils which retain available moisture throughout the summer. In New Zealand and in South Eastern Australia, where such conditions are more general, it has developed into a very serious weed, but it need not be feared that such will be generally the case in South-Western Australia, except in the above mentioned places. The plant is most prevalent in the Bridgetown, Donnybrook, Greenbushes and Boyanup districts and the environs of Bunbury, and at several places between there and Perth along watercourses, especially the Serpentine River. To a less extent it is found in the Darling Range, and small patches may be found as far east as Brookton, but in this last-named locality it does not produce much growth, and consequently is not as serious as in the higher rainfall areas.

The Blackberry is a proclaimed Noxious Weed for the State of Western Australia, but the problems attending its eradication are confined to the summer-moist soils of the South-West, where, if left unchecked, it is likely to prove troublesome. The principal disadvantages of the plant, are its tenacity, and the dense, impenetrable growth formed by its thorny stems which spread by means of suckering, so that a single plant can, in a short time, cover many square yards of ground, occupying good land to the exclusion of productive plants, and always advancing.

Once established, the plant is difficult to eradicate, since the roots repeatedly produce fresh brambles (stems) which, the more they are cut back, the thicker they grow. Mechanical eradication is an arduous task, and is expensive because of the necessary repetition of operation. Burning only serves as a temporary check, and thus has little ultimate effect. The most successful treatment appears to be the use of chemical sprays. Good results have been obtained by spraying with sodium arsenate and sodium chlorate, especially the latter. Sodium chlorate should be used in a 10 per cent. solution, applied during December or January. The solution should be applied in the form of a very fine spray, and care taken to moisten as much of the foliage as possible. This is essential, since the action of the poison takes place through the leaves, by which it is absorbed and carried down the stems into the roots, killing the plant downwards.

Where a dense bank of Blackberry is to be treated it is often quite impossible to entirely cover the leafy areas in a single operation with the spray, owing to th density of the growth. An initial spraying will, however, kill the superficial areas, allowing of an effective treatment of the underlying portions later on.

If the dead stems and leaves are to be burned, burning should not be resorted to until the chemical has killed the stems back to the roots, otherwise its action is arrested. This also applies to the cutting back of the stems. The spray should produce its maximum result within four weeks, and no burning or cutting should take place until this time has elapsed after the spraying operation.

Experiments conducted by Messrs. Meadly and Elliott, of this Department, in January, 1930, were successful in completely eradicating clumps of Blackberry at Jarrahdale which were about 6 feet high and 20 feet in circum-

Blackberry.

ference, by burning, five or six weeks after the application of a 10 per cent. solution of sodium chlorate. The new shoots which had appeared by the time

that burning was resorted to were thus given a set-back, and the remaining dead stems were cut away. A further growth some time later was sprayed with a 10 per cent. solution, which completely killed the plants.

See "Chemical Weed Killers," by H. G. Elliott and G. R. W. Meadly, Leaflet 330.

For particulars of the plant see accompanying plate.

EXPLANATION OF PLATE.

A. Twig, showing habit (reduced).
B. Leaf, slightly less than natural size.
C. Flower (natural size).
D. Fruits (slightly less than natural size.
E. Fruit (natural size).

Whitby Falls, Western Australia .. .. Icon. origin.

THE RACKING OF SEED POTATOES.

J. C. Palmer (Dept. Agric.), Potato Inspector.

The practice of racking seed potatoes prior to planting is one which is adopted in many of the potato growing areas of the world. It is followed in countries of such widely divergent climates as that of Canada and Ireland. Though, in general, the potato growers of Western Australia do not rack their seed, yet the majority of the more successful ones do make this practice a general part of their routine work. This is the case, more particularly in the Albany and lower South-Western districts, and raking could be introduced profitably in some of the other potato areas.

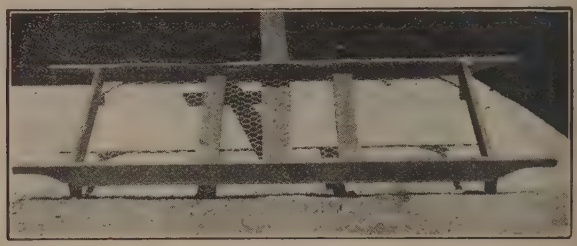
Methods of Racking.—In some localities the growers tip out their seed in a thin layer on the ground, on the floor of a shed, or under the shade of some bushes on old bags. This, however, is not a practice to recommend except in those cases where the grower has no better facilities for racking. The objections to this method of handling seed are that inspections during the greening stage are more difficult and the tubers are liable to become infected by soil-borne diseases such as Rhizoctonia and Blight, more particularly where the potatoes are spread out on old bags.

A better method of handling seed is to tip it out in thin layers on racks or in sprouting boxes. Such potatoes are left exposed to air and sunlight, though, of course, direct sunlight is kept away from them by shading in some way.

In some districts, the racks are spread out in the shade of trees; in others, they are placed in rough sheds—open on all sides except the weather side. Some growers again place their racks in heaps in the open and then cover them with a light covering of hessian or of boughs.

Types of Racks.—Various types of racks are used and it is more or less a condition of local practice which is the best type to use. A very useful type for a man with a small area is one which is used extensively in the market-growing areas of England. This "sprouting box" is simply a shallow box with handles so that it can be carried about. In the Albany district a variation of this is seen where half kerosene tins are used. The seed is "greened" in them and handles are fitted in when occasion arises to move the tins to the field at planting time.

This Department always racks the seed used in the various manurial trials. The rack used is of simple construction—made of jarrah, and the "floor" of it covered with wire netting. Details of this rack are given below. It is constructed of 6 in. x 1 in. jarrah and 2 in. wire netting, with 2 in. x 2 in. legs with a clearance



A Seed Rack.

of 4 in. Such racks will hold about a bag and a half of potatoes and can be handled by two men. Further, this type can be stacked one on top of the other in any convenient place.

The cost of construction is relatively light. Some growers—more particularly in the Denmark area -use "bush" racks. These consist of wire netting roughly nailed to bush poles and laid on poles or black-boy stumps. The difficulty of such racking is that of filling the bags and lack of portability.

Method of Stacking Racks.

Labour Involved.—Racking, of course, necessitates a certain amount of labour. The potatoes have to be emptied out of the bags on to the racks and then placed back again in bags prior to planting. Further, while the potatoes are on the racks they have to be turned over, and all potatoes showing signs of rotting or disase removed. Still, as an offset to this question of labour, the work could be performed at odd times during any spare time that the grower may have. After all, the labour is justified if an increased crop is obtained later on in the paddock.

When potatoes are stored in sacks, more particularly under more or less dark conditions, they sprout. Such sprouts are long, thin, weakly-looking, whitish growths and, being very brittle, are easily knocked off the tubers in the cartage to the planting area. A certain amount of vigour is withdrawn from the tuber in the formation and growth of the sprouts, and should any, or all, of these be knocked off, it follows that there is a definite loss of strength in the seed; further, the succeeding shoots will not be as healthy as the original ones.

When potatoes are racked properly, the sprouting is checked to a certain extent. The sprouts which are formed are short, sturdy and healthy, and coloured according to the variety of the potato. With "Delawares" these shoots are of a dark green colour. When potatoes with good, strong, vigorous shoots are planted, they "come away" earlier, and from them can be expected healthy plants.

Greening.—One great advantage of racking is that during this process the skin of the tubers becomes greener and harder. Such "greening" tends to promote an early maturity and, further, it renders the tubers less susceptible to insect and fungus attack. Another advantage is that the hardening of the skin of a well-"greened" potato renders the tuber practically immune from infection from the soil. All potatoes must go through a resting period before they will make fresh growth, and racking tends to arrest the growing period, and so the resting period is passed through earlier than with potatoes stored in bags in sheds. Under the latter treatment, of course, the tubers are maintained at a more or less warm temperature and so the resting stage is delayed.

What to Look For.—Perhaps one of the greatest advantages of racking is the detection of disease in the potatoes so treated, as any abnormality can be quickly noticed. Inspection alone will enable the grower to weed out of his tubers all those which are of an undesirable shape, or of a variety foreign to the bulk of the sample. These should include all potatoes which are pointed at the end or unduly elongated, as such specimens may be infected with virus trouble or Rhizoctonia. Of course it is impossible to be definite in such cases, but it is better to be too drastic in the rejection than to risk having a poor crop to dig. One definite abnormality can be detected, and that is "thready eye" or "spindle sprout." Instead of healthy, normal sprouts, the tubers send out thin cotton-like shoots, which will never develop into strong, sturdy plants, even if they develop into plants at all. The practical grower will never plant such tubers, whatever the cause of the "thready-eye" may be, as he is anxious that every "set" shall develop into a healthy plant.

During racking—especially when the racks are left in the open—dirt and extraneous matter is washed away. This gives the grower an opportunity of estimating the amount of Rhizoctonia infection of his seed. The resting stage of this disease is shown by small black, earth-like spots in the skin of the tubers; dirt washes off, but Rhizoctonia does not. If it is found necessary to treat the seed for this disease, and it is always advisable to do so, it should be dipped before the shoots are too far developed.

Some of the potatoes may be infected with one of the wilts, either fusarium or bacterial. Such tubers will go soft and should be removed to prevent a possible infection of healthy seed.

Even the most careful of diggers is liable to injure the skins of potatoes when digging the crop. This injury may have become infected with disease from the soil during the picking up. A callous may form over such injury, or on the other hand it may not. Sunburn causes many potatoes to grow soft by breaking down the cells at the injured places in the skin. Racking shows all injured potatoes which can be rejected if necessary.

Since racking affords an opportunity of rejecting unsuitable and diseased seed, it is obvious that the crop from such seed will be—other conditions being equal—a heavier one than that obtained from unracked seed; thus racking is recommended as a profitable part of the routine work of every grower of potato crops. The aim of the grower should be selection of the best type of seed, and racking is a valuable aid in this direction, and the more vigorous his selection and rejection of the unfit, so the better chance he has of growing a high tonnage to the acre.

DISINFECTION OF TOBACCO SEED.

EFFECT ON GERMINATION.

G. R. W. Meadly, B.Sc.,
Agricultural Adviser.

Owing to the fact that diseases of tobacco, particularly Blue Mould (*Peronospora sp.*) under local conditions, may be carried by means of seed infection, treatments have been devised for the surface disinfection of tobacco seed before planting. The one generally employed and recommended by the Department is to soak the seeds in absolute alcohol in order to destroy any infection present on the outside of the seeds. The seeds are held in a piece of muslin which is folded into the shape of a bag, tied, and the whole immersed in absolute alcohol for five minutes. When taken out, the seed is drained, spread on blotting paper, and dried as quickly as possible. The mass is frequently stirred, and an electric fan or radiator is also sometimes used in order to hasten the evaporation.

A number of inquiries have been made concerning the effect of this treatment upon the viability of the seeds. In order to dispel any doubt in this direction the following table consisting of the results of a number of tests carried out during the last season is shown. The germinations before and after treatment with absolute alcohol, as well as the varieties treated, are given:—

Test Nos.	Variety.	Germination before Treatment.	Germination after Treatment.
1656-1657	Hickory Pryor	86	86
1736-1737	Bonanzo	80	86
1819-1820	Conqueror	71	71
1821-1822	Warne	73	69
1823-1824	Dungawan	62	72
1825-1826	Hickory Pryor	70	76
1827-1828	Hester	30	33
1829-1830	Spotted Gum	20	19
1831-1832	Hickory Pryor	88	80
1836-1837	Hickory Pryor	76	72
1938-1839	Hickory Pryor	76	74
1840-1841	Hickory Pryor	97	97
1844-1845	Hickory Pryor	60	56
1846-1847	Hickory Pryor	98	90
1848-1849	Hickory Pryor	76	74
1850-1851	Warne	62	60
	Average	70	70

Considering experimental error, the two columns show quite good agreement, thus demonstrating that the germinating power of the seed is not reduced if reasonable care is exercised.

The seeds should be dried as soon as possible after being taken from the alcohol, and if a radiator or any other heating apparatus is used during the drying operation, extreme care must be taken to prevent the tobacco seed from becoming excessively heated. Experiments which I have carried out with an electric incubator prove that any temperature above 40° C. (104° F.) which continues for an appreciable time is sufficient to destroy the viability of tobacco seed when moist.

Thus, it is evident from the above notes and disinfection work performed by the Plant Pathology Branch of this Department, that with reasonable care the germination of tobacco seed is not reduced by treatment with alcohol.

FEEDING WHEAT TO PIGS.

G. K. Baron-Hay, Superintendent of Dairying.
(Reprint.)

Enquiries are being received daily as to the profit likely to be derived from the feeding of wheat to pigs, and whether, with wheat alone available as a food, it is possible to rear pigs suitable for the bacon trade.

A visit to the metropolitan market at Midland Junction will convince the observer that many excellent bacon pigs are now being forwarded from wheat-growing areas, but it also will be obvious that large numbers are being incorrectly fed, with disappointing results to the owner when sold.

It is hoped that the following notes will be of value to those intending to market a portion of their crop of wheat in the form of pork or bacon.

MAKING A START.

While undoubtedly more profit is made from feeding pigs bred on the farm, this will be impossible in the initial stages, owing to the delay necessary for breeding and weaning the prospective bacon pigs.

A start will have to be made with store pigs, probably bought in the market.

The chief drawback to purchasing store pigs is the difficulty of obtaining a sufficient number of the right type and of even weights.

A long bodied pig, with long deep middle, heavy ham and a light shoulder is the type to purchase, and should be relatively lean, otherwise there may be a danger of fattening when too small.

The size of pig to buy for fattending will depend to a great extent on the cost of freight and cartage to and from market. The greater these costs the younger should store pigs be purchased, and fed to as heavy a weight as practicable, in order to spread this cost over as many bushels of feed wheat as possible.

There is a limit, however, to the weight at which young pigs may be purchased for feeding with wheat. Experience has shown that weaners cannot be purchased safely and reared on wheat as a basal ration. It is inadvisable to purchase pigs weighing less than 80 lbs. (live weight) for fattening purposes.

BREEDING.

The aim should be to breed one's own baconers as soon as possible. For this purpose good high grade sows of the Berkshire breed, or Berkshire-Tamworth cross, may be bought at almost any large pig sale to-day. These should show good length and depth, fine skin free from wrinkles. They should be fine in bone and have at least 12 well placed teats.

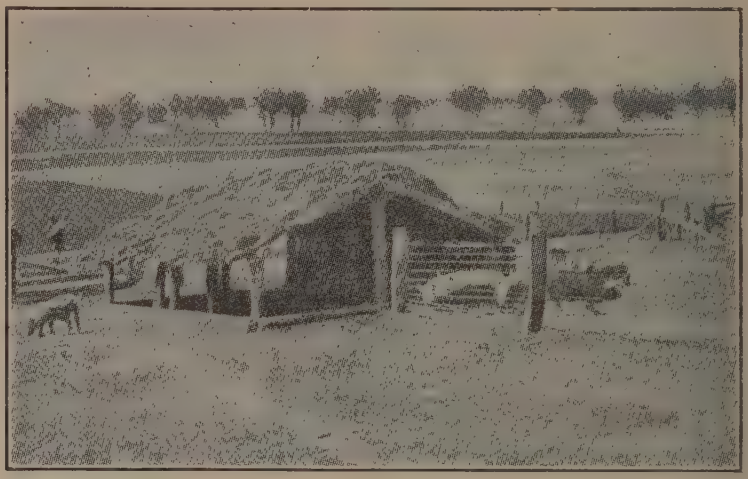
It is essential to obtain, from a reputable breeder, a pedigreed boar for mating with these sows, and if possible from a large litter. This boar should show all the essential points of a bacon pig (See article in "Journal of Agriculture," March, 1930—"The Bacon Pig," Bulletin 296.)

The pure bred Berkshire boar is recommended for general "grading-up" purposes.

SHELTER AND WATER SUPPLY.

On Wheat Belt areas it is essential that ample shade should be provided. Cheap temporary shelters may be made from saplings, the roof being of straw or boughs, and approximately 4 feet from the ground. These may be burned without serious loss, should they for any reason become foul.

A plentiful supply of clean water is also essential. The writer has in mind where a farmer lost several valuable sows through allowing them to drink water from a clay hole, the clay flocculating in the intestines, causing impaction. Water should be available from troughs only.



A cheap, effective shelter on a wheat farm.

FEEDING WHEAT.

Wheat alone is not a complete ration for growing pigs, being low in proteins for flesh building, and also lacking in mineral matter for skeleton formation. This deficiency may be made up in two ways:—

(1) By the addition of skim milk to the ration.

(2) By the addtion of meatmeal and bonemeal.

Skim Milk.—A large quantity of skim milk is not necessary to provide the protein required to form a complete ration. One gallon to each 4 lbs. of grain feed is sufficient, and also economises in grain.

Skim milk, if available, should be reserved for weaner pigs.

Meatmeal and Bonemeal.—Where skim milk is not obtainable, meatmeal must be fed in the proportion of approximately 8 per cent. of the grain ration. In addition, bonemeal should form 2 per cent. of the ration.

WHOLE OR CRUSHED WHEAT.

Wheat should be crushed or cracked before being fed, and provided this is carried out, there is no need to soak the wheat.

Uncrushed wheat, however, shows a loss as high as 20 per cent. over crushed wheat, through not being digested.

The cost of feeding can be considerably reduced by using self-feeders, allowing the pigs to have free acess to both wheat and meatmeal. It has been found in numerous feeding tests that self-feeders are economical in feeding, and that the pigs consume meatmeal at approximately 8 per cent. of the total grain consumption.

COST OF FEED CONSUMED.

The results of fifteen months' feeding on the Rutherglen Experiment Farm, Victoria, concluded last November, have shown that on the rations mentioned above, allowing the pigs to consume all they desire.

The average grain per pig per day = 1.35 lbs.

Feed per pig per day = 3.47 lbs. wheat and .28 lbs. meatmeal.

Feed per lb. gain in weight = 2.57 lbs. wheat and 20 lbs. meatmeal.

Pigs Pasturing.

The following table will indicate on these figures that the feeding of wheat to pigs, even at present prices of bacon, is profitable:

Pig purchased at 80 lbs., and fattened to 180 lbs. live weight.

	£	s.	d.
Purchase price 80 lb. pig (live weight) ..	1	5	0
Meatmeal consumed, 20 lbs. at 1.87d. ..	0	3	1½
Bonemeal, 4 lbs.	0	1	0
	£1	9	1½
Present day value	2	10	0
Value of wheat fed	£1	0	10½

or 4s. 11d. per bushel.

The net return will vary depending on the location of the farm from the market, but costs can be accurately worked out for any locality, using the above figures for food consumed.

BORDEAUX MIXTURE.*

THE MOST COMMONLY USED FUNGICIDE.

Simple Directions for its Preparation in either Small or Large Quantities.

H. A. Pittman, B.Sc.Agr., Plant Pathologist.

Ever since the discovery by Millardet, in 1882, in the Bordeaux district of France, of the strong fungicidal (fungus-killing) properties of a mixture of lime and bluestone, the mixture known as "Bordeaux" has been the leading spray material all over the world wherever fungous diseases have had to be combated. This fortunate discovery was the result of Millardet's chance observation of the protective action of such a mixture against the dreaded "downy mildew" disease of the grape (*Plasmopara viticola*), where the grape vines near the roadside had been conspicuously treated to discourage the boys of the neighbourhood from stealing the fruit, by giving them the impression that the grapes had been poisoned.

Although to some extent superseded of late years by Lime-Sulphur, especially in cool climates, as a summer spray on apples and stone fruit, and by such other substances as "dry-mix sulphur-lime," "atomic sulphur," "sulphur dust," copper-lime dust," "copper carbonate-sulphur dust," etc., for certain diseases, it still remains ". . . . the most widely known and the most generally useful of all spray liquids employed against parasitic fungi" (1).

GOOD QUALITIES OF BORDEAUX MIXTURE.

The great and lasting popularity of Bordeaux Mixture as a spray for the vine, and for most orchard, vegetable, and flower-garden plants, may be attributed very largely to its following good qualities:—

1. When properly prepared, it is remarkably adhesive to most types of stems, fruits and foliage. After it has once dried on the plant it can only be slowly removed by rains, dews, or other climatic influences.

2. It has a very high efficiency in preventing infection of the above-ground parts of plants by most types of fungi.

3. The cost of the ingredients required to make a large volume of spray is relatively low.

4. When used at the ordinary strength, it is quite harmless to most types of cultivated plants.

5. It has a decidedly tonic effect on the growth of many plant species, quite apart from its fungicidal action.

6. It is quite simple to prepare and safe to handle.

DRAWBACKS TO THE USE OF BORDEAUX MIXTURE.

1. Its main disadvantage is that the bluestone (copper sulphate), which is one of the essential ingredients, will speedily corrode iron or steel and all the other commonly-used metals or alloys except copper, brass or bronze. This difficulty is

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* Reprinted and revised from the article of the same name which appeared in the December issue of this "Journal" for 1930, pp. 600-609, owing to the leaflet embodying this information now being out of print.

usually overcome, in practice, by dissolving the bluestone in wooden tubs or casks, and by using bronze, brass, or porcelain-lined spraying equipment and accessories. On a small household scale the copper sulphate may be dissolved in copper, brass, bronze, glass or earthenware vessels.

2. Another disadvantage is that Bordeaux Mixture has been found very apt to cause injury to the leaves and fruit of apple and most kinds of stone-fruit trees (especially peaches and Japanese plums) if applied in the spring or summer *after* the "spur-bursting" or "bud-bursting" stage. To overcome this disability in the case of apples, only very weak strengths and an excess of lime are recommended from the "pinking" stage onwards, or weak "lime sulphur" may be substituted for the later sprays.

There is no difficulty in this State so far as Bordeaux injury to *stone fruits* is concerned, inasmuch as all the fungous diseases which occur here, as yet, on such plants, can be readily controlled by spraying with Bordeaux Mixture in the winter, or just as the buds are bursting in the spring, or, in addition, as the leaves are falling from the trees in the autumn, as the case may be. If these sprayings are carried out efficiently, there is, at present, no necessity for the summer spraying of stone fruits in this State.

Apricots are fairly resistant to Bordeaux injury and may be safely sprayed with the 3—4—50 strength when the fruit is well set to half-grown, if necessitated by the seriousness of "Shot-hole."

Bordeaux Mixture should only be applied during warm, dry weather, as injury is most likely to occur if the spray is used during, or just preceding, rainy or dull, humid, slow-drying climatic conditions. The addition of an efficient spreader (see section on spreaders near the end of this article) will also tend to lessen the danger of russetting the fruit or causing leaf injury. Further information *re* using Bordeaux Mixture as a spray for apples after the "spur-bursting" stage will be found on pages 254-263 of the June issue of this "Journal" for 1930, or on pages 17-23 of Department of Agriculture Bulletin No. 306, entitled "Black Spot or Scab of Apples and Pears in Western Australia."

3. The only remaining serious objection to the use of Bordeaux Mixture is that it imparts a bluish colouration to sprayed plants, so that it is sometimes considered unsightly on ornamental or flower-garden subjects, and it cannot, of course, be used on produce just prior to marketing. For this latter purpose, ammoniacal copper carbonate or very dilute Burgundy mixture (1-1¼-50) should be used instead. (Ammoniacal copper carbonate is made by mixing 5 ounces copper carbonate in a non-corrosible container with sufficient water to make a thick paste. Then add 3 pints strong ammonia –26° Beaumé—to dissolve the paste. Then add a little more copper carbonate with frequent stirring (up to about 1 oz.) till no more can be dissolved. Then dilute with water to make 50 gallons.)

4. Evidence is accumulating that Bordeaux Mixture may increase drought injury of certain plants grown under very dry conditions by increasing the transpiration ratio. Under such circumstances, however, fungal troubles should not be of sufficient importance to necessitate spraying.

HOME PREPARATION OF BORDEAUX MIXTURE ADVISABLE.

Many farmers, orchardists, vignerons, vegetable-growers and home-gardeners in this State are under the erroneous impression that Bordeaux Mixture is difficult to prepare, and, in consequence, obtain their copper fungicide as a powder already mixed. Numerous experiments the world over have indicated that ready-made

so-called "Bordeaux" Mixtures are not as effective, or as adhesive, as the freshly-prepared, properly-made, home-made mixture. Considerable burning of fruit and foliage has sometimes followed the use of commercial "Bordeaux" powders in this State. Mason, in his "Spraying, Dusting and Fumigating of Plants" (3), writes, "Bordeaux Mixture is the one spray which, if used in any considerable quantities, should always be made on the farm, the commercial forms being of less value than the freshly-made products."

USE OF LIME ESSENTIAL FOR THE PREPARATION OF TRUE BORDEAUX SPRAYS.

As already indicated, Bordeaux Mixture takes its name from the district in France where it was first discovered. True Bordeaux Mixture is always made from bluestone and quick lime (or, alternatively, hydrated lime) in a manner more or less as given below. Owing to the fact that quick lime rapidly deteriorates when in contact with the air, its use in ready-made powders, which may be kept in store for long periods before being used, is a practical impossibility. Consequently in commercial powders washing soda is generally used. Such substances are not properly called "Bordeaux" mixtures, but should be known as "Burgundy" mixtures, after the area in France where the bluestone-soda formula was first used.

Burgundy mixtures are much more apt to "burn" plant tissues than true Bordeaux sprays. Whereas increasing the amount of lime in a Bordeaux Mixture decreases its likelihood of causing injury, increasing the amount of soda in a Burgundy mixture, above a certain point, rapidly increases its "burning" properties.

Burgundy mixture has now very largely gone out of use on account of its caustic properties, although it was formerly very much used in some parts of the world as a substitute for Bordeaux.

FORMULAE FOR MAKING BORDEAUX MIXTURE.

The formula in most general use, at the present time, for most vegetable, flower-garden and fruit plants, is that known as "4–4–50." This means 4 lbs. of bluestone and 4 lbs. of "freshly-burnt," "stone," or "quick" lime to every 50 gallons of the mixture. 4–4–40 (i.e., 1–1–10) is another commonly used formula.

The standard formula may be varied, so as to allow for a greater or less proportion of bluestone to lime, as experience indicates to be necessary for the control of a particular disease and the avoidance of spray injury to the species of plant concerned. Thus 6–6–40 is used in Western Australia for the "bud-bursting," "pre-blossoming" and "fruit set" sprayings of the vine against "Anthracnose" (*Gloeosporium ampelophagum*), but later sprayings, if required, are given at 6–6—50, and the writer considers 2—5—50 all that would be permissible or necessary here for the summer spraying of apples against "black spot," should that disease become at all widespread (see Department of Agriculture Bulletin No. 306).

THE FIRST FIGURE IN THE FORMULA MEANS LBS. OF BLUESTONE.

In all formulæ for the preparation of Bordeaux Mixture the first figure given is the number of pounds of bluestone, the second figure is the number of pounds of "freshly-burnt," "quick" or "stone," lime, and the final figure indicates the full number of gallons to which the mixture must be made up with water prior to spraying.

DIRECTIONS FOR PREPARING BORDEAUX MIXTURE IN SMALL QUANTITIES FOR HOME GARDENS.

A small quantity of Bordeaux Mixture of very nearly 4–4–50 formula (actually 4–4–48) can be prepared by taking:—

(1) 4 ozs. bluestone,

(2) 4 ozs. "freshly burnt," "stone," or "quick" lime,

and making up to a final volume of 3 gallons as indicated below:—

a. Dissolve the 4 ozs. of bluestone in a wooden tub or wooden barrel, or a copper, bronze, brass, glass or earthenware vessel, using 1½ gallons of water. The bluestone may be dissolved by suspending it overnight in the water in a piece of hessian, bagging or linen, from a stick placed across the mouth of the receptacle; or by heating the water and pouring it over the bluestone in the bottom of the receptacle, if the mixture is required in a hurry.

b. Slake the 4 ozs. of quick-lime, which must be quite fresh and of good quality, in another container, by adding water a little at a time. A small wooden cask is convenient, but, unlike the bluestone, an iron vessel such as a clean empty kerosene tin may be used in which to slake the lime. **When slaked, make up to 1½ gallons with water.** This suspension and partial solution of lime in water is known as "milk of lime."

c. Pour the two liquids simultaneously through a copper, brass or bronze wire strainer into the spray outfit, or into a wooden or other non-corrosible container, and, after seeing that the volume is exactly three gallons, use immediately.

An alternative method is to first strain the milk of lime into the spray outfit through a piece of bagging to remove any gritty particles or lumps which might clog the sprayer, and then pour in the bluestone solution, keeping the milk of lime well agitated while doing so. See that the final volume is correct and commence to spray immediately.

Fig. 1.—A type of knapsack sprayer suitable for use on small areas. Note the Spring Lever Tap (Trigger Grip Control) with which the spray can be released or stopped instantly. The liquid capacity is 3¼ gallons. Such a machine can be obtained with a copper tank for spraying with Bordeaux Mixture, made of special brass alloy for spraying, in addition, with Lime Sulphur or similar sulphides, or with all parts lead-coated for spraying with acids such as Sulphuric Acid, as used for the control of "anthracnose" of grapes, etc.

(*After "Vermorel Eclair Export Catalogue,"* No. 22, 1932.)

The bluestone solution and the milk of lime can be kept indefinitely, so long as they are kept separate and any evaporated water is replaced to each before using; but once they have been added to each other the spraying must be commenced immediately and continued until all the spray is used up, as Bordeaux mixture soon deteriorates if left standing about after being made up.

Never mix the solid lime and bluestone together before adding the water. The more dilute each constituent is before meeting the other, the better.

STOCK SOLUTIONS AS A MEANS OF REMOVING THE DRUDGERY FROM THE FREQUENT PREPARATION OF BORDEAUX MIXTURE.

It rarely happens that a single spraying is sufficient to control a disease in plants. Even in those cases where a single spraying carried out at the right time does suffice, as with "Shot-hole" of stone fruits in many places, the orchardist usually finds that the different varieties are not all ready for spraying at the same time. This usually means that the spraying period is protracted and the grower becomes impatient at having to continually make up "from scratch" a fresh lot of spray. Frequently, also, a grower finds, on going to use his quicklime, that it has become air-slaked, with the result that a new lot of quicklime must be ordered for delivery in a hurry. This may cause fraying of tempers and there is always the possibility of a lot of damage being done by disease in the meantime, before the new lot arrives. A certain amount may be used out of the new consignment, and again deterioration may take place by the time the remainder is required.

Difficulties of the above nature may be readily avoided if the growers will appreciate the following facts:—

Although, when once prepared, Bordeaux Mixture must be used immediately, the separate ingredients, i.e., the bluestone and the lime, can be kept in concentrated form in water for very long periods without deterioration taking place, and ready for use at a moment's notice.

METHOD OF MAKING UP THE STOCK SOLUTIONS.

The procedure is as follows:—

1. **Work out approximately how much bluestone and lime will be required to carry out your spray programme.** (It usually takes about 2 gallons of liquid to spray a well-grown apple, stone-fruit or citrus tree in this State for the control of fungous diseases, and anything from 100 to 150 gallons to cover one acre of vegetable crops such as almost fully-grown potatoes. Various factors will tend, however, to vary the amount required, and the experienced grower will know best just how much he will need for a particular area or job.)

2. **Then dissolve the bluestone in water in wooden casks or other non-corrosible containers at the rate of 1 lb. to every gallon of water.**

This can best be done by suspending the bluestone over-night, in a sugar bag or cut-down chaff bag, from a stick placed across the mouth of the cask and so arranged that the bluestone is just beneath the surface of the water. If wanted in a hurry, the crystals can be fairly readily dissolved by pouring hot water over them at the rate of about 1 gallon of hot water to every 3 lbs. of bluestone.

3. **Slake the "freshly burnt," "stone" or "quick" lime in other containers at the same rate as the bluestone, i.e., so that each gallon of the concentrate contains in it one pound of quick-lime.** This is done by adding water, a little at a time, until all the lime is slaked, and then bringing the water level up to the required height in the containers. Iron vessels are quite suitable to make the lime concentrate in, but wooden casks are generally used.

The New South Wales Department of Agriculture has carried out a series of experiments and finds that **lime may be stored under water even for periods of twelve months. There is a slight decrease in the effective lime amounting to about ¾ per cent., but this decrease is so slight as to be negligible (4).**

Only a little of the lime actually goes into solution, the major portion eventually sinking to the bottom of the container.

To check evaporation, a few drops of lubricating oil (not spraying oil) may be placed on the surface of each concentrate and a mark should be made at the surface of each lot when it is finished with for the time being, so that any water which has evaporated may be replaced before using it again. Covers could also be placed over concentrates to prevent animals or children interfering with them, and they should be protected from rain, dust-storms, etc., when not in use.

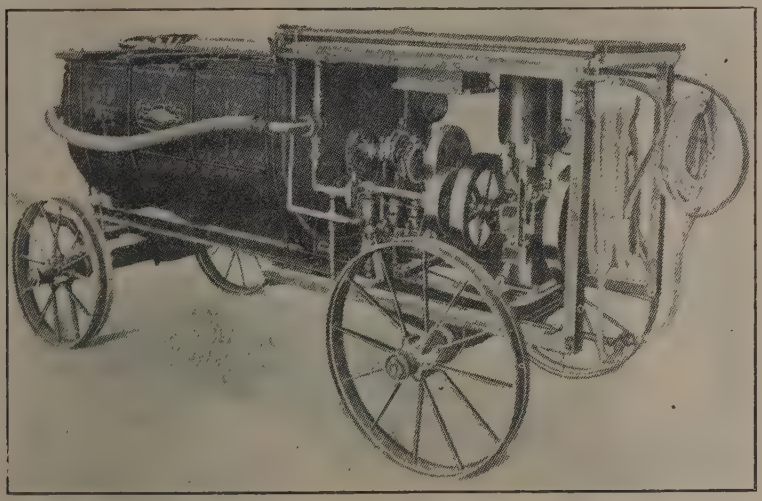

Fig. 2.—A power sprayer of American make especially suitable for orchard work. The spray tank holds 200 gallons. The machine is drawn by two horses.
(*After W. J. Allen, in "Spraying"—"Farmers' Bulletin," No. 72, 2nd edit., N.S.W. Dept. Agric., June,* 1915.)

PROCEDURE TO BE FOLLOWED WHEN MAKING THE BORDEAUX MIXTURE FROM THE CONCENTRATES.

There are two alternative methods which may be used for making the Bordeaux Mixture from the concentrates.

The first method is the simpler, but does not give quite as good a spray mixture as the second. The second method gives the best possible mixture, but involves the use of a little more equipment than the first.

First Method.

a. **Stir the lime concentrate thoroughly, being especially particular at the sides and corners of the container, so as to get a uniform distribution of the lime in the water, and, when thoroughly well mixed, dip out the full amount required, remembering that, when well stirred, each gallon of lime concentrate contains the equivalent of one pound of quick-lime. Pour the lime into the spray tank through a piece of bagging, or, better still, a fine wire sieve containing 18-20 meshes to the inch, to remove any gritty or coarse particles which might tend to block up the spraying equipment.** (A copper, brass or bronze wire sieve is the best, as it can then also be used for the bluestone when the time comes.)

If 4–4–50 Bordeaux was being prepared, for example, and it was proposed to make 50 gallons, it is obvious that 4 gallons of lime concentrate would be required to be sieved into the spray tank. The lime requirement is always the second figure in the formula.

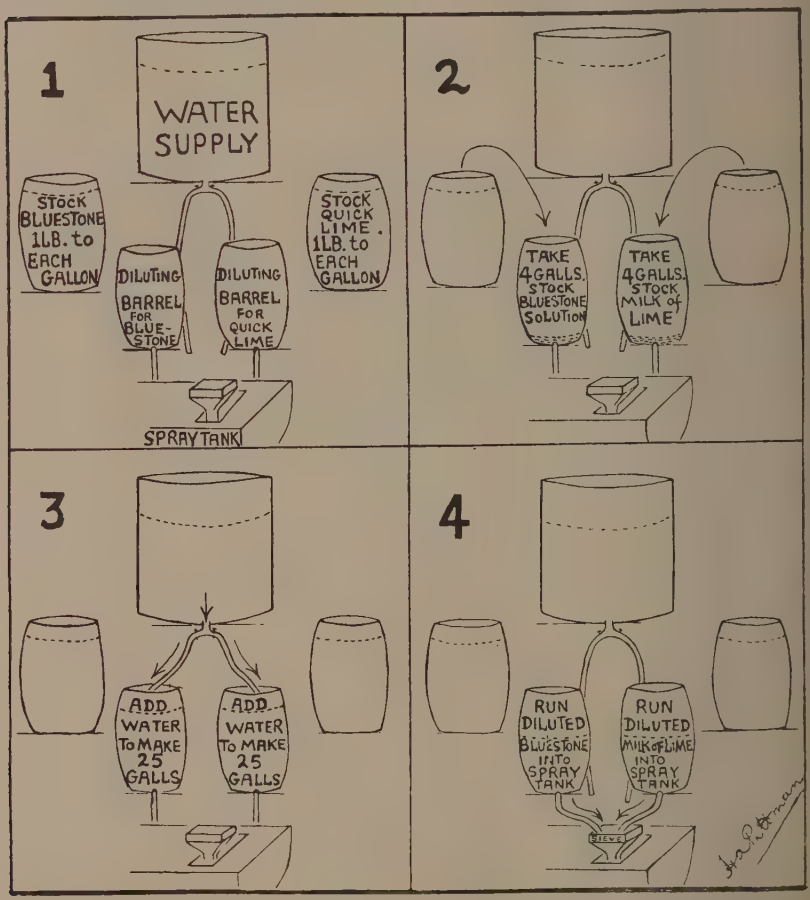
1
WATER SUPPLY
STOCK BLUESTONE 1LB. to EACH GALLON
DILUTING BARREL FOR BLUE-STONE
DILUTING BARREL FOR QUICK LIME
STOCK QUICK LIME. 1LB. to EACH GALLON
SPRAY TANK
2
TAKE 4 GALLS. STOCK BLUESTONE SOLUTION
TAKE 4 GALLS. STOCK MILK of LIME
3
ADD WATER TO MAKE 25 GALLS
ADD WATER TO MAKE 25 GALLS
4
RUN DILUTED BLUESTONE INTO SPRAY TANK
RUN DILUTED MILK of LIME INTO SPRAY TANK
SIEVE

Fig. 3.—Diagrammatic representation of method of preparing 4-4-50 Bordeaux Mixture from Stock Solutions of Bluestone and of Lime. The Stock Solution of Bluestone is made by dissolving 1 lb. of Bluestone to each gallon of water, and the Stock Solution of Quicklime by slaking, in a separate container, 1 lb. Quicklime for each gallon of "milk of lime" required, in the manner indicated in the text.

(1.) Apparatus and solutions ready for preparing the Bordeaux.

(2.) Four gallons of concentrated bluestone solution have been placed in one of the dilution barrels and four gallons of concentrated "milk of lime" in the other.

(3.) Water is added to each dilution barrel to bring the volume in each to 25 gallons.

(4.) The diluted bluestone and diluted lime are then run simultaneously into the spray tank through a brass, bronze, or copper wire strainer having 18-20 meshes to the linear inch. The agitator is kept running during this process.

(*Drawing by Author. Not to scale and details of taps, etc., have been omitted.*)

b. After sieving the lime concentrate into the spray tank, add water to the tank until it contains about three-quarters of the total volume of spray to be

made; i.e. in the specific case under consideration, fill up the tank to about 40 gallons.

c. **Set the agitator going and strain in the required amount of bluestone concentrate, remembering again that each gallon of bluestone concentrate contains 1 lb. of solid bluestone.**

For the 4 – 4 – 50 formula being discussed, then, we would need 4 gallons of bluestone concentrate to be sieved through the brass, copper or bronze sieve into the agitated and diluted lime in the spray tank. (There should really be no need to sieve the bluestone solution, except that small pieces of straw, etc., which might block up the sprayer, might have been blown into the solution during the storage period.

d. We have now arrived at the stage where about 43 gallons of liquid, containing a light-blue flocculent precipitate, are in the spray tank. **If a spreader is to be used, it should now be added, and then the volume should finally be brought up to 50 gallons with the necessary amount of water.**

Second Method: To be used, wherever possible, in preference to the first. (See Fig. 3.)

This method is preferable to the first, but necessitates two extra containers, The underlying principle is that the ideal Bordeaux Mixture can only be prepared if both the lime and bluestone concentrates are diluted as much as possible (i.e., in each case to half the total volume of the Bordeaux to be made) before running them together simultaneously through the brass, bronze or copper wire strainer into the spray tank.

In the case of the 4 – 4 – 50 formula under discussion, for example, 4 gallons of bluestone concentrate are diluted to 25 gallons, with water, in a second wooden barrel or other suitable container. Four gallons of lime concentrate are similarly diluted in a wooden or iron container to 25 gallons, and then both lots of the diluted materials are run together simultaneously through the non-corrosible sieve into the spray tank, by means of taps and rubber hoses let into the bottoms of the dilution vessels. (See Fig. 3.)

THE MIXTURE MUST BE USED IMMEDIATELY IT IS PREPARED.

Use the Bordeaux Mixture immediately, if possible, but if, for any unforeseen reason, it has to be kept standing for some time before use, first add to it one-eighth of an ounce of table sugar (cane-sugar) for every pound of bluestone which has been used. In the example being considered, ⅛ oz. x 4 = ½ oz. of table sugar would need to be used. The table sugar prevents the deterioration of the flocculent (flake-like) blue precipitate to which the Bordeaux Mixture owes its desirable qualities. (One heaping tablespoonful of table sugar equals one ounce.)

AN ELEVATED STAND VERY CONVENIENT.

For the most convenient preparation of Bordeaux Mixture a wooden stand should be erected handy to an overhead water tank or other source of water supply. The vessels to hold the concentrates and the diluted ingredients are placed on the stand, which is built of such a height that the tank on the spray outfit can be conveniently filled by the force of gravity. In this way all heavy lifting is obviated, the only liquids requiring to be lifted being the small quantities of concentrates

required for every 50 gallons of mixture. Instead of a wooden stand a vertical cut through a hillside or earth bank may be made to allow the spray equipment to pull up in front of, but below the level of, the mixing site.

Fig. 4.—A good type of elevated stand for the preparation of Bordeaux Mixture and the convenient filling of the spray outfit. Stock solutions may be diluted in the two central barrels on the lower platform, and run into the spray tank through a large pipe and hose extending out from between the barrels. The stock solutions of copper sulphate (bluestone) and lime may be kept in other barrels on the lower platform, or in two large barrels on the top platform. It is better if the top platform is reserved for the water supply, which may be held in large barrels or an iron tank. If an iron tank (galvanised or otherwise) is used to hold the water supply, care should be taken that it is not splashed with the bluestone solution, or, better still, it should be well protected on the outside with good quality paint or tar to prevent corrosion.

(*After Mason, "Spraying, Dusting and Fumigating of Plants."*)

PURITY OF THE INGREDIENTS ESSENTIAL.

The bluestone bought should be of at least 98 per cent. purity. It should be in the form of large dark-blue crystals, and should not contain any appreciable amount of the greenish-coloured sulphate of iron which is sometimes met with in commercial samples of bluestone. It may be tested by dissolving a small quantity in water, diluting this with extra water in a tumbler until it becomes a light-blue colour, adding a little ammonia and then stirring well. A pale-blue precipitate of copper hydrate is first formed, but this quickly dissolves, if enough ammonia is present, to give a very intense violet-blue colour. The formation of a reddish-coloured precipitate or sediment indicates the presence of iron.

THE LIME MUST BE FRESHLY BURNT.

With reference to the lime used for the preparation of Bordeaux Mixture, it is of extreme importance that the lime should be freshly burnt. To test whether this is so, or to see if it has become to any extent water- or air-slaked, a few lumps should be placed in a heap and sprinkled with water. Freshly-burnt lime will become very hot, give off a quantity of steam, gradually fall to pieces and crumble to a fine white powder. Some lime will not do this readily with cold water, but may do so if hot water is used. If the lime does not get hot enough to give off steam, even with hot water, it is unsuitable.

Water-slaked lime may be used, provided that it has only been slaked a day or two at the most, and that the correct adjustment is made to the formula. If using fresh water-slaked lime, increase the lime content of the formula by one-third to one-half extra. Air-slaked lime cannot be used under any circumstances.

In practice the best procedure is to very definitely specify "freshly-burnt" lime when ordering, and then to slake it immediately on its arrival and keep it under water until required, as described in a preceding section of this article.

Fig. 5.—Desirable type of power-sprayer for large orchard. Note the sturdy steel frame, underslung tank, large wide-tyred rear wheels and small front wheels which will run under the frame, making short turns possible. There is sufficient capacity to operate two spray "guns" at high pressure.

(*After Mason, "Spraying, Dusting and Fumigating of Plants."*)

TESTS FOR BORDEAUX MIXTURE.

Bordeaux Mixture is said to owe its valuable fungicidal properties to a basic copper sulphate from which the ordinary copper sulphate is reformed in very small quantities from time to time. These quantities are too small to harm the tissues of most plants, but are yet quite sufficient to kill the germinating seed bodies

(*spores*) of harmful fungi. If, by some mischance, there should happen to be too little lime in the Bordeaux Mixture to completely turn the bluestone into the insoluble basic sulphate, considerable injury could be caused to any plants sprayed. While there should be very little likelihood of this happening if ordinary care is taken, each lot of Bordeaux Mixture made up should be tested, before using, in one or other of the following ways:—

A. Take a little of the Bordeaux Mixture in a glass vessel, add a few drops of acetic acid, and then add a few drops of a solution of ferrocyanide of potassium in water. (The strength of the ferrocyanide should be 4 ozs. in one pint of water. Both the ferrocyanide and the acetic acid are obtainable from any chemist.) Should any brown discolouration occur, the Bordeaux Mixture does not contain enough lime, and more lime concentrate must be added, until, on further testing, no discolouration is apparent.

B. A rough but useful test which can be made to see if the Bordeaux contains enough lime to neutralise the bluestone, is to dip the clean blade of a penknife, or a bright piece of iron such as a roughened-up shiny nail into the mixture for several minutes. If the mixture does not contain sufficient lime, a reddish-brown deposit of copper will form on the iron and more lime should be added. *Always use a little too much lime rather than a little too little,* as quite a considerable excess of lime may be used without the fungicidal properties of the spray being markedly lowered.

Fig. 6.—Spray boom of excellent type, showing the arrangement of nozzles to ensure thorough covering of such crops as potatoes, tomatoes, beans or similar plants grown in rows.

(*After Mason, "Spraying, Dusting and Fumigating of Plants."*)

THE USE OF SPREADERS WITH BORDEAUX MIXTURE.

Whenever Bordeaux Mixture is used, the spreading, wetting, and adhesive qualities of the spray will be very greatly improved by the incorporation of a special spray "spreader" or "sticker." In addition, the spray, on drying, will

settle down into a very thin, well-distributed and more or less continuous layer, rather than into a number of scattered spots. The fungicide will therefore prove more efficient with a "spreader" than without, as, where the spray dries up in spots, very little, if any, protection is afforded to the tissues in between. Where spreaders are used there is also very much less danger of damaging the leaves or fruit, for the reason that the concentration of the solid materials from the spray is never so intense at any one point as if no spreader is used. Moreover less spray is used as there is not such a tendency to hold the spray nozzles for some time in the one place to try and *force* the material to wet the tissues and stay on.

CALCIUM CASEINATE SPREADER.

The following substances are some of those which have been used from time to time as spreaders or stickers, in various sprays: oils, resins, soaps, glue, milk and molasses, but *calcium caseinate*, a by-product obtained from skim milk, is the only one which has become very popular or widely used.

Calcium caseinate should be used at the rate of one half to one pound (½—1 lb.) per 50 gallons of spray. In mixing, make the required amount of calcium caseinate into a paste in a billycan, jug, or other suitable receptacle, by putting the caseinate into the dry container and then adding as much water by volume as there is caseinate. Stir, so as to form a thin paste (just in the same way as powdered skim milk is mixed by the experienced housewife for human use) and, when made into a paste, dilute with water and add to the mixture in the spray tank, keeping the agitator going during the process.

SPREADERS FOR BORDEAUX MIXTURE OTHER THAN CALCIUM CASEINATE.

If calcium caseinate is not obtainable, one or other of the following substances may be used instead:—

1. A good brand of *commercial powdered skim milk*, used at the rate of ½—1 lb. for every 50 gallons as indicated above for calcium caseinate.

2. *Sweet skim milk*, used at the rate of half a gallon to every 50 gallons of spray.

3. *Flour*, used at the rate of ½—1 lb. to every 50 gallons of spray. Mix with water to a thin paste and then add to the mixture in the spray tank.

4. *Glue*, ½ oz. to every 50 gallons of spray. Dissolve in hot water and then add to the mixture in the spray tank.

5. *Good quality soft soap*, 2—3 lbs. per 50 gallons of spray. Dissolve in water and add to the spray mixture in the spray tank, or barrel, *only just before the spray is to be used.*

6. *"Resin-Fish Oil" Soap*, 2—3 lbs. per 50 gallons of spray. Dissolve in water and add to the spray mixture in the spray tank, or barrel, *only just before the spray is to be used.*

"Resin-Fish Oil" Soap is especially valuable as a sticker and spreader in Bordeaux Mixture for spraying smooth-leaved plants such as cabbages, onions, carnations, etc.

7. For spraying citrus trees or other plants which are not injured by white spraying oils, ½ to 1 gallon of such oil may be used as a spreader in every 50 gallons of spray.

Another advantage in the case of citrus is that the use of the oil acts as a check on scale insects which otherwise are very apt to increase to serious proportions following Bordeaux sprayings, unless only the lower half or two-thirds of the tree is sprayed. (See Leaflet 354 on "Brown Rot of Citrus and Its Control.")

In using any spray spreader it is advisable not to make the spray liquid in the spray tank, or barrel, up to the full volume until *after* the spreader has been added, so that the strength of the fungicide will always be as much as possible the same whenever it is made up to the same formula. In other words, if making up a 4—4—50 Bordeaux, the *final* volume of spray after the spreader has been added, should be just 50 gallons. A mental attitude of exactness should be maintained all through the operations of preparing the Bordeaux Mixture. Carelessness or "slip-shod" methods in weighing out or preparing the materials, or in any other part of the operations, cannot be too strongly deplored.

FINAL NOTE.

Finally it should be pointed out that before using the spray apparatus, especially after it has been idle for any length of time, it should be thoroughly washed out to remove any chemicals which may have been left from the previous spraying. This is exceedingly important when the spray being used is a different kind from that previously employed, as, according to Cunningham (2), this mixing of different spray materials in the tank is one of the most frequent causes of spraying injury to plant tissues.

BORDEAUX PASTE.

It is very desirable, after removing large branches from trees, or after cuting out diseased tissues from the trunk or root system where some such disease as Armillaria or Collar Rot is being dealt with, to paint the wound with some antiseptic material which will prevent invasion of the wound before it heals over.

Bordeaux Paste is one of the best materials which may be used for this purpose, or for painting over the wounds made in grafting, after the scion has been inserted and before the grafting wax is applied.

Various formulae are used such as 1½—3—2, 1—2—1½, or 1½—4—1½.

For making up Bordeaux paste according to the first formula (1½—3—2) take 1½ lbs. of bluestone, 3 lbs. quicklime, and 2 gallons of water.

Dissolve the 1½ lbs. bluestone in half the water, *i.e.*, 1 gallon. Slake the 3 lbs. of quicklime with the other gallon of water. Then pour together and stir thoroughly before using. Apply with a brush as soon after the wound is made as possible.

When not in use the mixture should be kept in a closed container.

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(4) New South Wales Department of Agriculture—"Spray Leaflet, No. 1, Bordeaux Mixture." Sydney, 1930.

"THE JOURNAL OF AGRICULTURE"

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SUCKLING CLOVER

(*Trifolium dubium,* Sibth.).

C. A. Gardner,
Government Botanist.

Suckling Clover, or Yellow Suckling Clover, is one of the minor annual clovers of our pastures. Originally planted on a fairly extensive scale in the more primitive pastures of the South-West, the plant has become firmly established there, and is now a more or less common constituent of the majority of pastures.

The clover is a small yellow-flowered plant which, if given space in which to develop, assumes a more or less creeping habit like that of Hop Clover, but is smaller in all its parts and more densely foliaged, extending to a diameter of from 6-9 inches. Under conditions of dense growth or root competition it grows erect, and may be as high as 12 or 16 inches, but is correspondingly decreased in width.

Suckling clover is commonly seen in the South-West, either as a naturalised plant almost anywhere where clearing has taken place, or growing with the various pasture plants, especially in the low-lying or moister situations, usually with Drooping-flowered clover and Subterranean Clover. It can always be distinguished from the major clovers by reason of its yellow flowers; from *T. filiforme* it can be readily distinguished by the number of flowers in the head—5-15 (*T. filiforme* has 2-5)—and from Hop Clover by its smaller flowers and standard being not grooved.

Although a palatable clover, Suckling Clover is not worthy of cultivation in the clover lands of the South-West. It is too small to provide any considerable bulk of feed, and occupies space that would be better devoted to more valuable

Suckling Clover.

plants. In permanent pasture it is to be regarded as a weed, aand where more valuable clovers flourish it remains an undesirable constituent of pastures.

For the lighter rainfall areas, however, it has a decided value. It is a much superior plant to Woolly Clover, Hop Clover and Narrow-leaved Clover, and appears to be capable of thriving on more or less acid soils. The clover would be valuable in areas where the rainfall is between 18 and 14 inches. In lower rainfall areas its success would be doubtful. Where it will thrive under the drier conditions it must be regarded as a valuable clover and one which enriches the soil.

Although a common and troublesome winter weed of lawns, it can be safely recommended for golf course fairways, providing a dense mat of herbage which will withstand rough treatment, making a good soil-binder during the spring, and its low habit of growth further recommends it for this purpose. The rooting system is strong and well developed.

Samples received for testing during the last nine years give the following results:—

Purity—84.6 per cent.
Germination—60 per cent.
Hard seeds—27 per cent.

Commercial lines of suckling clover usually contain some of the following impurities:—

Cluster Clover, Yorkshire Fog, *Amaranthus retroflexus*, Chickweed (*Cerastium vulgatum*), Rib grass (*Plantago lanceolata*), Sorrel (*Rumex acetosella*), French Catchfly (*Silene gallica*), and Chickweed (*Stellaria media*).

On the other hand, Suckling Clover is a common impurity in the following lines of seeds:—

Yorkshire Fog, Prairie Grass, Rye grasses, Lucerne and almost all clovers, especially White Clover.

The seeds are small, yellow, oblong-elliptical, smooth and shining, with a prominent radicle.

THE GRADING OF TOBACCO LEAF.

A. R. C. Clifton, Officer in Charge of Irrigation.
E. T. Morgan, Officer in Charge Potato Branch.

The publis taste is the prime factor in determining the value of tobacco and governs the price paid by the buyer to the grower of tobacco for his leaf. At present, a very high percentage of the tobacco consumed is used in the making of cigarettes, though formerly most of the tobacco produced was used by pipe smokers. The ideal tobacco for the manufacture of cigarettes is that from bright lemon-coloured, fine textured leaves, with desirable smoking qualities. It is generally found that the lighter the colour the milder the leaf and that it is more difficult to produce bright lemon-coloured leaf than the darker grades. For this reason buyers for the tobacco firms are much more interested in this "light" coloured tobacco than in the "dark." These buyers value leaf according to its aroma, texture, and whether its colour is approaching lemon yellow or not. The grading of tobacco leaf into the grades required by the buyers is unfortunately not receiving sufficient attention by the growers in general. Those growers, however, who are attending to this matter, are obtaining higher prices than those offering ungraded leaf. It has been estimated that grading makes a difference of 3d. per lb. in the price. The difference may be greater than this, for the buyer has no means of determining the quantities of the different grades and therefore will buy safely.

Ungraded leaf has to be graded in the factory and, therefore, the cost of this work will be allowed for in the price paid between the buyers and sellers in their transactions. However, there is little prospect of any ungraded leaf being sold in the future, and, therefore, growers must grade their leaf before offering it for sale.

Care and attention in this work will be repaid as buyers are more favourably disposed to handle a carefully graded crop.

GRADING.

This commences at harvesting by roughly sorting the longs and shorts, and the sound and damaged leaf when stringing on, the different grades being kept separate in the barn and in the bulk. When the crop is uneven, this work can be simplified by detailing certain pickers to gather leaf from a particular part of the stalk and each picker's leaf should be kept separate. The reason for this is that the texture of the leaf from each plant varies according to its position on the stalk, and it frequently happens that as the subsequent cures are being put through, it is likely that first, second, and third primings have to go into the same cure.

If this is done the grading is largely a matter of sorting according to colour and size. Though exact differentiation of colour requires practical experience, yet the tobacco grower could easily grade his leaf according to the chart submitted below.

Classes of Leaf.	Colour.	Size.	Grades.
1 Lugs—(leaves near the ground)	Lemon ... Orange Mahogany ... Dark	Short ... Medium ...	1 and 2
2 Cutters—(thin elastic leaf)	Lemon ... Orange Mahogany ...	Short ... Medium Long ...	1 and 2
3 Fillers and wrappers—(medium to heavy leaf)	Lemon ... Orange Mahogany ... Dark	Short ... Medium Long ...	1 and 2
4 Nondescript—(green, badly sunburnt, etc.)			

Small growers, of course, would not be able to grade their leaf into as many grades as indicated by the chart, but none the less they should endeavour to follow this table as closely as possible, and at least grade their crop according to colour and size.

Since colour is of such importance in the grading of the leaf, adequate lighting must be given in the grading shed. Each worker should, if possible, be allotted a portion of the bench to himself. In front of him should be bins or trays in which to place the leaf as he classifies it. It is not easy to determine colour in either direct sunlight or by artificial light, and the lighting should be so arranged that the shadow of the grader does not fall on the leaf. The best type of lighting is either from overhead skylights or from a series of windows in front of the grader over the bench. These should not face either in an Easterly or a Westerly direction. During the grading of the leaf the graders should separate and grade separately all leaf which is very short or nondescript and that which is too green. For obvious reasons, too, the best leaf is that which has the smallest proportion of rib and vein to leaf surface, and is fine-bodied with a fair degree of toughness and elasticity. The usual method employed is to bring several "sticks" of leaf on the bench, then after removing the strings, the leaf is left lying in one direction. Care, of course, is to be taken that leaf it not left hanging longer than is necessary or

that it is unduly exposed to light, since under such conditions it loses sheen and colour. Attention must also be paid to the moisture content of the leaf, that it is neither too moist or yet too dry. In the former case, when made up into "hands," it may become affected with mould and, in the latter, of course, it becomes too brittle to be handled.

When grading tobacco one should always remember that if the colour is doubtful at all, the leaf should be placed in the next lower grade, *taking care to keep out any leaf showing green colour,* which should be handled separately.

After the leaf has been graded, it is made up into "hands." These are made up by taking a number of leaves—usually 12 to 15 or more, according to size—and placing them with the butts all pointing in one direction. These are encircled by the thumb and forefinger and held together by wrapping the butts with a smaller leaf of similar grade. This smaller leaf or tie, *which must be of the same colour as the hand,* is folded back along the mid-rib so that the topside of the leaf is exposed. The tie-leaf is then wrapped round the hand, commencing with the tip and finishing with the butt end, the latter being held in position by tacking it between the leaves of the finished hand. A better job of the hand can be made by placing the tie over the end of the butts and then wrapping it around. The finished tie should be from 1½-2in. in width, according to the length of the leaves in the hand. The hand should have a diameter of approximately 1 inch, so that when completed with the tie-leaf, the circumference of the butt of the "hand" will be about 3½ inches. The length of the leaves in each hand should be approximately the same. The hands should be in such a condition that when the leaves are squeezed together, they will separate themselves on being lightly shaken.

RELATIVE FOOD VALUES.

L. C. SNOOK,
Agricultural Adviser, Dairy Branch.

For the benefit of those farmers who find it necessary to purchase concentrated foodstuffs for their dairy cattle, a table has been prepared, showing the relative values of common supplements at current market rates:—

RELATIVE VALUES OF CONCENTRATES FOR DAIRY CATTLE.

DECEMBER, 1932.

Foodstuff.	Cost.	Cost per 100 lbs.	Starch equivalent per 100 lbs.	Digestible Protein per 100 lbs.	Cost per lb. of Starch equivalent.	Cost per lb. of Digestible Protein.
		s. d.			d.	d.
Wheat ...	3s. per bushel of 60 lbs.	5 0	72	9·0	0·83	6·7
Oats ...	1s. 9d. per bushel of 40 lbs.	4 4½	60	7·0	0·88	7·5
Bran ...	£5 17s. 6d. per ton	5 3	50	9·0	1·26	7·0
Linseed Meal	14s. 6d. per 100lbs.	14 6	76	26·0	2·29	6·7
Meat-meal ...	7s. 9d. per bag of 50 lbs.	15 6	90	60·0	2·07	3·1
Peas ...	5s. per bushel of 60 lbs.	8 4	72	17·0	1·19	9·5

Most dairymen have to contend with a protein shortage during the summer months, and if the yield of the milch cows is to be maintained some type of protein supplement must be fed. Linseed-meal has proved very popular for this purpose, but its use is often restricted for financial reasons. Fortunately, it appears that a much cheaper, and in many ways preferable, source of protein is available in the form of meat-meal.

Meat-meal is not generally considered as a food for dairy cows, but there is no apparent reason why it should not prove very successful as such. According to the table, meat-meal is by far the cheapest source of protein on the market, costing less than half as much per unit as the next cheapest. It is manufactured in our own State and is sterilised during its preparation. Meat-meal is a very concentrated food, and it would only be necessary to add relatively small amounts to the ration, hence no problem of palatability should arise. Meat-meal is rich in mineral matter, particularly phosphorus, and also contains lime, of which much is required by dairy cows. As far as one can gauge without undertaking an actual feeding trial, meat-meal should prove an excellent addition to the ration of lactating and growing livestock.

The cheapness of wheat as a food should also be noted. Wheat is as cheap a source of protein as linseed-meal and also supplies much cheap energy-producing material, but, being not so concentrated, is unsuitable as a sole source of protein. Elsewhere in this Journal will be found an article dealing with wheat as a food for dairy cows. This should be carefully perused, as full advantage of the low price of wheat should be taken by stock-owners.

Peas have been included in this table to indicate their value as a protein-rich foodstuff. Every farmer should endeavour to grow several acres of field peas for conservation as a cheap supplement to use during the summer months.

IMPORTANCE OF CAREFUL SELECTION OF RAMS AND EWES FOR LAMB BREEDING.

H. McCallum, Sheep and Wool Inspector.

The Fat Lamb Industry has brought into prominence certain of the British breeds of sheep. Many of these have been bred locally or imported from the Eastern States, and in most instances the quality reflects great credit on the breeders and has enabled a very solid foundation to be laid in the lamb breeding industry. The keen demand for sheep of these breeds, has, however, permitted a serious menace to creep into the industry. Some unscrupulous dealers have purchased animals of doubtful pedigree, or culls from good flocks, and disposed of them locally. With such sheep, especially as sires for a flock, the breeder will never achieve his objective, for they are weak in constitution and usually lack the main characteristics of the particular breed, therefore, their use will do untold harm to the industry. It is imperative, therefore, that when buying sheep for lamb breeding every care be taken to ensure that the animals are bred true to type and have the guarantee of the breeder. An offer of a very cheap lot should be regarded with caution: better to commence on a small scale with a few good sheep than buy up a large number of inferior animals.

The selection of the ewes to mate with the British breeds of rams is another very important factor to success in lamb breeding. The indiscriminate use of a flock of farm ewes cannot be expected to produce the uniform line of lambs so

desirable for the market. A prospective breeder should first decide on what lines he will work, then make arrangements to have his rams delivered when required, and then go through his ewes and select the largest framed, strongest constitutioned of them, paying due regard to uniformity, trueness to type, and general conformation; ill-nourished, badly-shaped, and under-sized mothers cannot be expected to produce lambs that will market in a prime condition. The progeny of badly selected breeding stock is to be seen at almost every sale, and their presence has a very detrimental effect on the prices. It costs no more to rear a first-class lamb than an inferior one, and this fact must be borne in mind by all breeders.

The lamb from ewes selected with due regard to constitution, conformation, vitality, fertility and trueness of type, mated to selected pure-bred sires, shows up in strong contrast to the animal bred haphazardly, when in the market pen, and meets with a very ready sale at a good price.

Feeding, of course, also plays its part in making a success of the venture, and all breeders must realise that it is essential to provide reserves so that the ewes can be kept in good condition prior to lambing and right up till the time the lamb is marketed. The slightest set-back in development greatly retards the maturity of the lamb, with consequent effect on prices received.

The sheep committee of the Royal Agricultural Society in deciding to reject all animals not up to standard at the show sales took a big step in the right direction, and breeders now have the assurance that all stock offered at these sales can be purchased with a guarantee as to their quality.

There are many breeders of the British breeds of sheep in Western Australia, and those embarking in the industry can purchase high grade breeding stock locally at very fair prices. Sometimes the price asked may seem higher than stock are offering in the markets, but the fact that the stud breeder has had to import and purchase his stock at very high prices, and carefully select his flock, must not be lost sight of, for lamb breeders are also purchasing, though perhaps indirectly, the results of his experience.

To prepare good pastures and water supply, select suitable ewes, purchase high grade pure-bred sires, feed all stock well, and handle carefully should be the practice of every lamb breeder who wishes to achieve success.

MARKET REPORT.

Messrs. H. J. Wigmore & Co. Ltd., of Wellington Street, Perth, have supplied us with the following information regarding the Chaff available for auction at the Perth Railway Yards, for the period September to November inclusive.

September.—675 tons of Chaff: F.a.q. to prime Wheaten Chaff was making from £4 2s. 6d. to £4 5s.; f.a.q. from £3 15s. to £3 17s. 6d. per ton. Medium quality was selling at from £3 7s. 6d. to £3 10s. per ton. Prime Oaten Chaff was finding buyers at auction and to arrive, at from £4 2s. 6d. to £4 5s. per ton; f.a.q. from £3 12s. 6d. to £3 15s.

Oats: Good heavy feed Guyras, Algerians and Mulgas were selling at from 1s. 10d. to 2s.; good feeds from 1s. 7d. to 1s. 8d. per bushel. Owing to short supplies of good heavy feeds towards the end of the month, the market firmed from 2s. 1d. to 2s. 4d. per bushel.

Wheat: F.a.q. was changing hands at from 3s. 4d. to 3s. 6d., second-grade from 3s. 1d. to 3s. 3d. per bushel.

October—835 tons of Chaff: At the beginning of the month the market for f.a.q. to prime Wheaten Chaff remained at £4 5s., and towards the end of the month eased to £4 per ton. F.a.q. found buyers at £3 15s.; medium quality from £3 5s. to £3 7s. 6d. per ton. Best samples of Oaten Chaff realised from £3 17s. 6d. to £4 2s. 6d., several consignments of well cut Oaten Chaff made up to £4 5s. per ton. F.a.q. was realising from £3 12s. 6d. to £3 15s.

Oats: Good heavy feeds were making from 2s. 1d. to 2s. 4d., good feeds from 1s. 9d. to 2s. per bushel.

Wheat: F.a.q. was selling at from 3s. 1d. to 3s. 5½d.; second-grade from 2s. 11d. to 3s. 0½d. per bushel.

November—795 tons of Chaff: F.a.q. to prime new season's Wheaten Chaff was finding its way on to the Perth market, and selling at £4; old season's at £4 2s. 6d. per ton. F.a.q. both old and new season's found buyers at £3 15s. Prime new season's Oaten Chaff was realising from £4 to £4 2s. 6d.; f.a.q. at from £3 15s. to £3 17s. 6d. per ton.

Oats: New season's Oats commenced to find their way on to the Perth market, and good heavy feeds were sold at from 1s. 10d. to 2s. 3d.; good feeds from 1s. 8d. to 2s.; light feeds from 1s. 4d. to 1s. 6d. per bushel.

Wheat: At the beginning of the month f.a.q. realised 3s. 8½d.; but towards the end of the month new season's wheat was finding its way on to the Perth market, and prices eased to 3s. 1½d. per bushel.

H. J. Wigmore & Co. Ltd., hold auction sales in the Perth Railway Yards, each morning, for Chaff, Grain and Potatoes, and all consignments forwarded to their care receive their best and prompt attention. The highest market prices with prompt returns are guaranteed.

LIVE STOCK AND MEAT.

For the information of readers of this "Journal," the following particulars have been supplied by Messrs. Elder, Smith, and Coy., Ltd., Perth:—

COMPARATIVE NUMBERS OF STOCK SOLD AT METROPOLITAN FAT STOCK MARKETS, FOR MONTHS OF SEPTEMBER, OCTOBER AND NOVEMBER, 1932.

	September.				October.				November.				
	7.	14.	21.	28.	4.	12.	19.	26.	2.	9.	16.	23.	30.
Sheep	14,736	13,089	12,706	12,198	11,547	15,257	15,160	12,744	12,173	17,046	15,585	12,518	12,803
Cattle	649	520	575	294	276	436	393	456	473	516	448	597	603
Pigs ...	1,387	1,533	1,291	2,017	987	1,855	2,105	1,846	1,244	1,497	1,059	1,419	879

COMPARATIVE VALUES PER POUND.

Mutton	4¾d.	4¾d.	4¾d.	4¾d.	4¾d.	3¾d.	*2¾d.	2¾d.	2¾d.	2¾d.	2¾d.	2¾d.	2¾d.
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Pork ...	4¼d.	4¾d.	5d.	5¼d.	5¼d.	5¼d.	5¼d.	5d.	5d.	5d.	5d.	5d.	5¾d.
Bacon	5¼d.	5¼d.	5¼d.	5¼d.	5d.	5d.	5d.	5d.	5d.	4¾d.	4¾d.	4¾d.	4¾d.

* Shorn.

METEOROLOGICAL INFORMATION.

STATIONS.	SEPTEMBER. TEMPERATURE. Maximum. Mean.	Maximum. Highest.	Minimum. Mean.	Minimum. Lowest.	RAINFALL. For Month.	Average.	OCTOBER. TEMPERATURE. Maximum. Mean.	Maximum. Highest.	Minimum. Mean.	Minimum. Lowest.	RAINFALL. For Month.	Average.	NOVEMBER. TEMPERATURE. Maximum. Mean.	Maximum. Highest.	Minimum. Mean.	Minimum. Lowest.	RAINFALL. For Month	Average.
					inches.	inches.					inches.	inches.					inches.	inches.
Chapman State Farm	70·6	81·6	44·8	39·1	1·12	1·64	77·9	91·5	53·7	42·4	1·44	0·96	82·4	101·4	55·3	48·3	0·03	0·82
Geraldton	70·4	83·2	51·1	40·6	0·91	1·38	75·1	92·2	55·4	44·1	1·34	0·70	...	...	...	...	*Nil*	0·26
Walebing	68·2	81·3	43·4	33·1	1·08	2·19	72·4	92·3	48·9	37 5	2·65	1·34	82·6	104·6	52·9	43·3	0·03	0·53
Perth	67·8	82·2	49·6	39·1	1·58	3·49	70·1	87·8	52·8	43·1	3·43	2·16	75·2	95·4	56·9	49·0	0·13	0·79
Kalamunda	65·9	77·0	47·5	38·1	2·38	4·82	70·4	84·0	49·2	41·0	3·48	3·10	76·5	95·1	54·3	46·5	0·36	1·02
Bunbury	65·0	74·5	47·2	37·2	1·03	3·69	68·2	77·0	49·2	43·0	1·72	2·42	72·1	86·0	52·5	44·0	0·44	1·00
Bridgetown	68·0	82·0	41·2	31·5	2·39	4·00	71·4	88·2	43·4	31·2	1·53	3·00	77·1	95·0	47·6	36·2	0·44	1·14
Albany	64·1	78·4	48·1	40·1	3·65	4·19	65·0	73·4	51·2	46·0	2·62	3·20	70·3	98·4	54·0	98·4	1·25	1·43
Merredin State Farm	70·0	82·5	41·1	28·3	0·56	0·92	71·6	85·9	47·9	35·3	3·14	0·74	82·8	99·3	53·4	42·0	*Nil*	0·43
Northam	70·1	81·0	43·6	34·0	1·08	1·64	72·1	90·0	49·2	37·6	3·51	0·98	82·2	100·2	53·8	43·0	0·07	0·39
York	68·9	80·0	43·1	32·5	0·68	1·63	70·9	86·5	48·4	38·0	4·51	1·01	81·1	100·0	52·6	43·0	0·02	0·42
Narrogin State Farm	65·2	74·0	42·0	29·9	1·40	2·36	67·3	80·0	44·1	33·6	3·24	1·40	77·1	97·6	48·0	39·6	0·19	0·57
Katanning	65·1	74·1	43·7	35·0	1·58	1·98	67·3	82·0	46·0	38·0	2·09	1·54	76·6	101·0	50·0	42·0	0·23	0·67
Cape Leeuwin ...	62·9	73·8	53·8	44·0	2·67	3·49	64·6	84·0	55·0	50·0	2·09	2·90	68·0	75·0	57·1	49·8	1·21	1·23

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